MACHINERY

AUGUST 2, 1961 ONE SHILLING & THREEPENCE

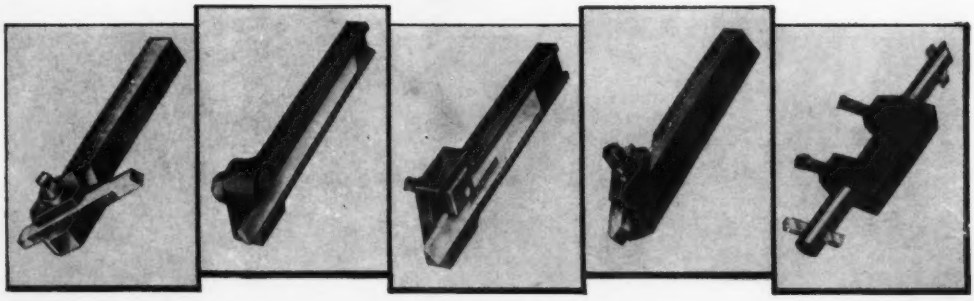
Eclipse

tool bits, lathe tools and tool holders

with many special features

"Eclipse" tool holders are manufactured with the utmost care from high quality materials, are carefully heat treated and incorporate a number of special features which enable them to do their job superbly well.

To complete the list of tools for turning and metal cutting, there is also the extensive range of "Eclipse" tool bits and lathe tools. Made from "Eclipse" H3 cobalt High Speed Steel, these tools are carefully heat treated to give the perfect combination of hardness and toughness — tools which can be relied upon to maintain a keen cutting edge.

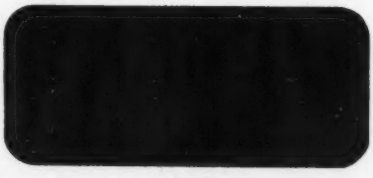


"Eclipse" hacksaw blades and other tools are made by James Neill & Co (Sheffield) Ltd., and are obtainable from all tool distributors.

"These Wild-Barfield furnaces do a really good job"

Where heat-treatment is concerned — are you doing the job as economically as possible? It's surprising the number of people who invest in expensive machine tools for production—and then spoil a good job in outdated furnaces. And the result? Rejects—time, money and probably customer goodwill lost. More and more people are relying on Wild-Barfield equipment. Write for full details and see how you can save by changing to modern electric furnaces.

Self-contained Electrode Salt Bath ESB 346.
Standard Model delivery ex stocks



ELECTRIC FURNACES
FOR ALL HEAT TREATMENT PURPOSES
Backed by 40 years specialist experience

WILD-BARFIELD ELECTRIC FURNACES LIMITED

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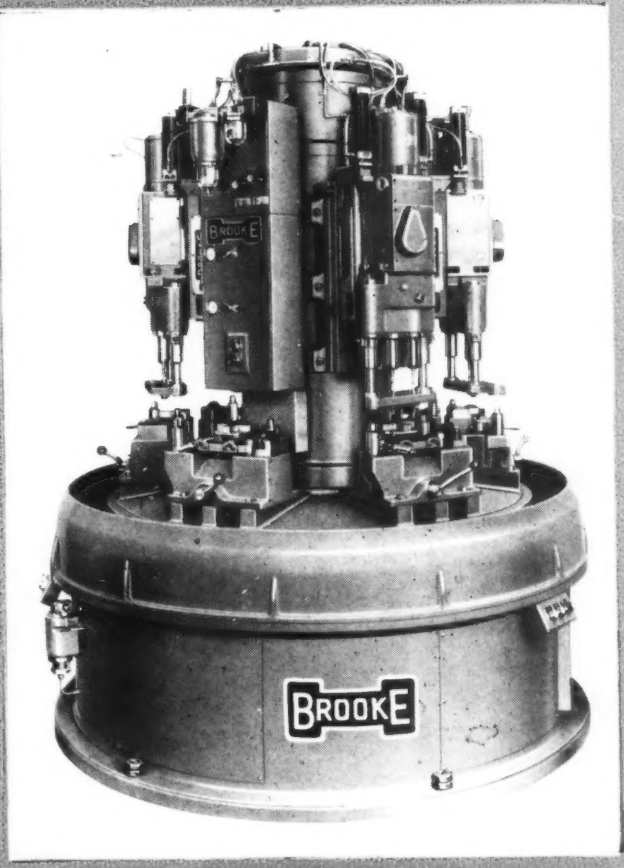
BROOKE

UNIT MACHINES AND UNIT HEADS

A new range of BROOKE Unit Heads and the new CENTRE COLUMN ROTARY INDEXING MACHINE (patents applied for)

Special features on this machine include:—

- ACCESSIBILITY OF HEADS AND TOOLING
- PATENT TABLE-CENTRALISING DEVICE GIVES ACCURACY OF 0·0005in. IN INDEXING AT THE OUTSIDE DIAMETER OF THE 60in. TABLE
- TABLE ON AIR-FLOTATION, HYDRAULIC OR AIR POWERED
- QUICK RE-TOOLING AT LOW COST
- ECONOMIC USE OF FLOOR SPACE



BROOKE TOOL AUTOMATION LTD.

CARDINAL WORKS, ALDRIDGE ROAD, PERRY BARR, BIRMINGHAM, 22b
Tel: Birchfield 4541/2/3/4.

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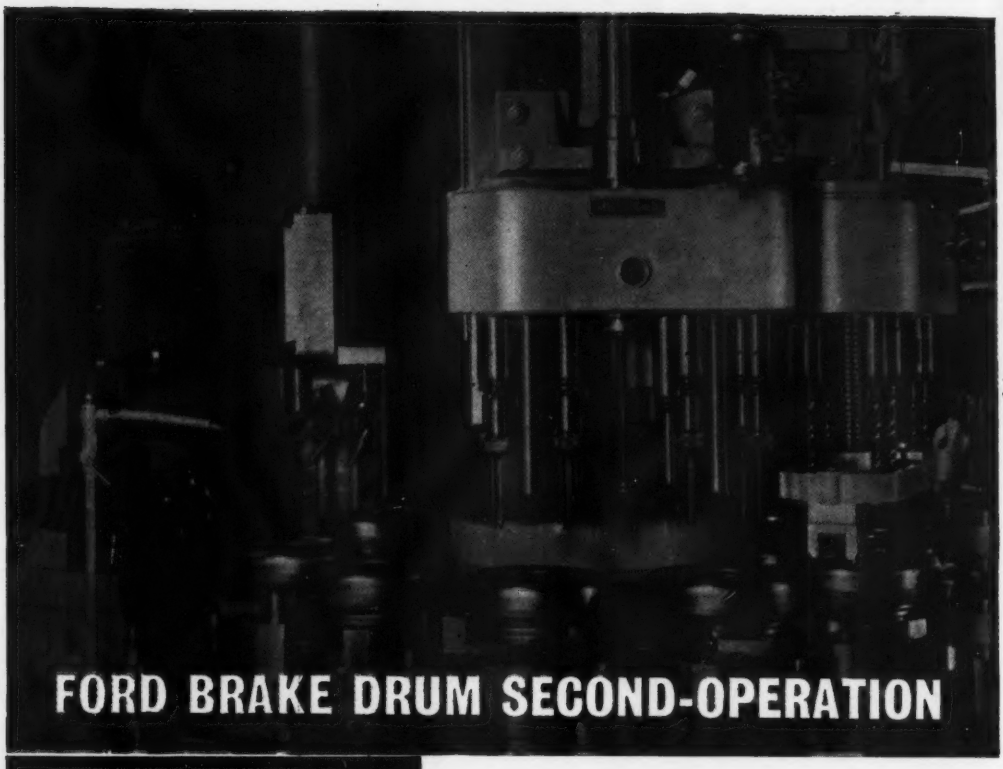
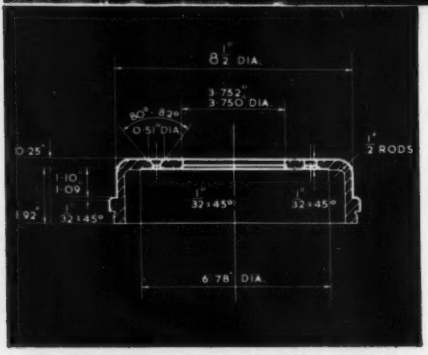


FORD BRAKE DRUM SECOND-OPERATION



MACHINED IN 40 SECONDS

The use of special Mulhead multi-drill heads on the Ryder Verticalauto enables drilling, reaming, countersinking and back-chamfering operations to be performed in addition to standard boring and facing work.

The second operation on this Ford Brake Drum is completed at very high output rates on this 12-spindle No. 10 Ryder Verticalauto.

Ryder ***VERTICALAUTO***

Thos. Ryder & Son, Limited, Turner Bridge Works, Bolton, England.
Makers also of single spindle Rydermatics and Piston Ring Lathes.

When answering advertisements kindly mention MACHINERY.

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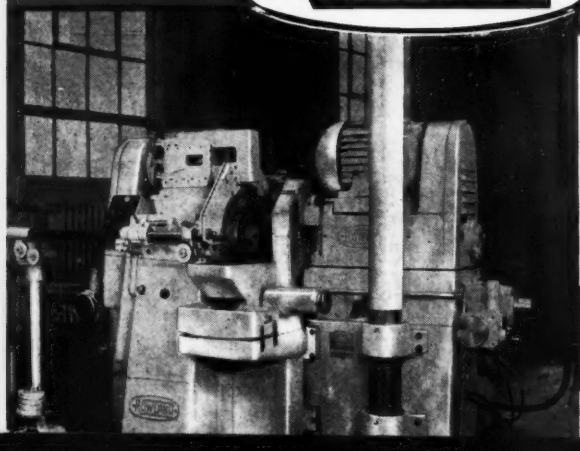
DUPLEX **ROWLAND** SURFACE GRINDERS



FINISHES BOTH SIDES SIMULTANEOUSLY

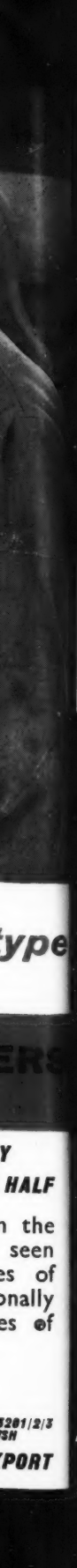
. . . . CUTS COSTS IN HALF

This machine, recently installed in the works of Spirax-Sarco Ltd., is seen simultaneonsly grinding both faces of small circular components to exceptionally fine limits at extremely high rates of production.

F.E.ROWLAND & CO.LTD.

PHONE: HEATON MOOR 3201/2/3
GRAMS: HEROIC REDDISH

CLIMAX WORKS, REDDISH, Near STOCKPORT



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ABWOOD

UNIVERSAL MACHINE VICES AND COMPOUND ANGLE TABLES FOR ALL ACCURATE WORK

Suitable for jig boring, grinding, milling and shaping machines. Movements are fully indexed through 360° in the horizontal plane and 90° in the vertical. Any combination of angles can be obtained.

Available with 4" and 6" jaw widths. Accurately indexed for angular work with spot sight and knife edge for register. Note the clean design, low height and rigid mounting. Angles cannot alter once the clamps have been locked.

Universal table fitted with interchangeable table. Changeover from circular to rectangular table is readily effected by loosening clamping bolts.
Available in two sizes. Circular 6" and 8" diameter. Rectangular 8" x 6" and 10" x 8".

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ABWOOD MACHINE TOOLS LTD., PRINCES ROAD, DARTFORD, KENT

Telephone : Dartford 25271 (5 lines)

Telegrams : ABWOOD DARTFORD

HOFFMANN

instrument bearings... fitted exclusively to THE MARCONI MARK IV TELEVISION CAMERA

NEW ADVANCE

Sensitivity, stability, consistency, and reliability—all are qualities of the new Marconi Mark IV television camera based upon a 4½ inch image orthicon pick-up tube.

The Marconi Mark IV has an exceptionally good performance under either natural or artificiai light, and such high stability of circuitry that a consistently high quality picture can be held without frequent re-adjustment of controls. In the B.B.C. Studio Number Three, the vision control officer is responsible for the controls of up to six Mark IV cameras. Obviously, each and all of these must be unfailingly consistent in optical and electrical performance. Equally their mechanisms must respond smoothly and instantaneously to the requirements of control. Here fourteen Hoffmann bearings play their part, ranging from $\frac{7}{16}$ to $\frac{1}{8}$ of an inch bore.

They are depended upon to give ease and smoothness of movement in such vital components as the Turret Mechanism, the Focusing Mechanism, and the Remote Iris Mechanism and Filter Kit.

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BALL AND ROLLER BEARINGS

Hoffmann Technical Service is freely available; we shall be pleased to help in your next project.

HOFFMANN

BRANCH OFFICES AND STOCKROOMS IN ALL PRINCIPAL TOWNS

TELEPHONE: CHELMSFORD 3151 TELEX No. 1951

HEAD OFFICE AND WORKS: THE HOFFMANN MANUFACTURING CO. LTD., (P.O. BOX 7), CHELMSFORD, ESSEX.

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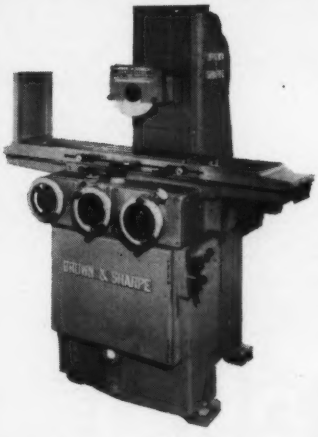


We are Sole Agents in this Country for Brown & Sharpe Manufacturing Company of Providence, R.I., U.S.A., and will be glad to provide full details of the complete range of Brown & Sharpe Surface Grinding Machines.

Designed by specialists to provide substantial savings and profits on every type of surface grinding job MICROMASTERS have all the capacity, all the speed and efficiency needed to meet today's toughest demands in the toolroom or on continuous production runs.

Unit assembly gives over a hundred combinations to meet every requirement.

Superior features of the MICROMASTER include :—

TABLE 6″ × 8″—gives superior accuracy and finish on surfaces to 108 sq. ins.

ULTRA-SMOOTH "ORIFLEX" DRIVE to wheel spindle.

FASTER, COOLER GRINDING—any desired table speed from 5 to 100 ft. per min.

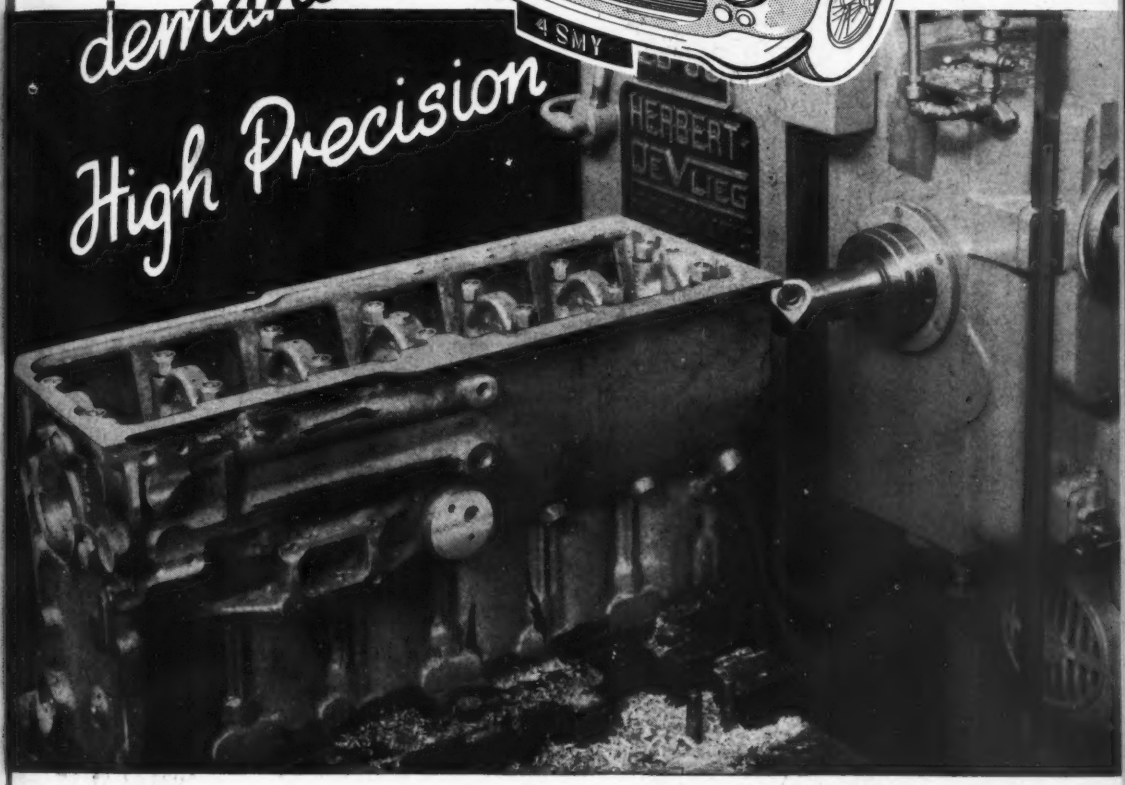
CAPACITY FOR BIG WORK PIECES—up to 15″ high under 8″ wheel.

"MICROMASTER" PRECISION—adjustable dials on vertical and cross feed handwheels graduated to read to 0.0002″. Fine feed knob for vertical adjustment graduated to read to 0.0001″.

BUCK & HICKMAN LTD.

Machine Tool Division—Otterspool Way, Watford By-Pass, Watford, Herts
Head Office—P.O. Box No. 74, Whitechapel Road, London, E.1
Branches—Alperton, Birmingham, Bristol, Glasgow, Leeds, Manchester

High Performance demands High Precision



Messrs. Aston Martin Lagonda Ltd., manufacturers of the power unit for the Aston Martin D.B.4 Saloon, rely on the Herbert/DeVlieg Jigmil for milling, boring and counter-boring operations on the cylinder head and block.

Using the principle of jigless boring, whereby work can be machined from two, three or four sides at one setting for milling, boring, drilling, tapping, facing or counter-boring operations in precise relationship, the Jigmil is the ideal machine.

Two sizes of Jigmil are now manufactured in this country:— the 2B-36 (capacity 24" vertical × 36" horizontal travel and 2½" dia. spindle) and the 3H-48 (capacity 36" vertical × 48" horizontal travel and 3" dia. spindle).

ALFRED **HERBERT** LTD., COVENTRY

AD 598

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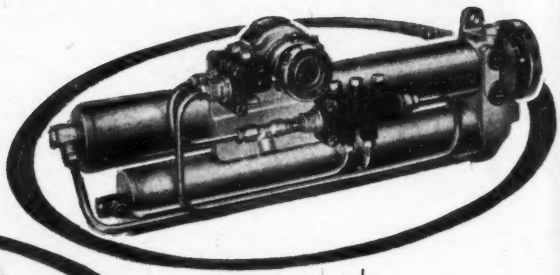
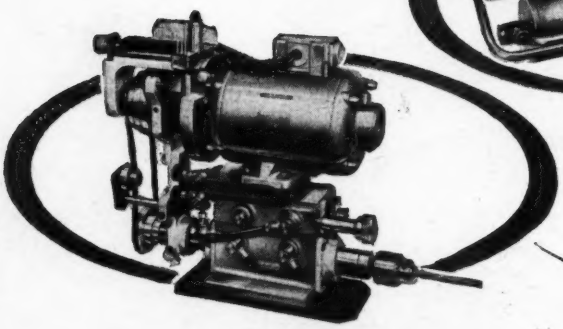
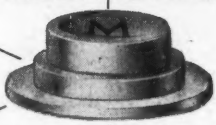
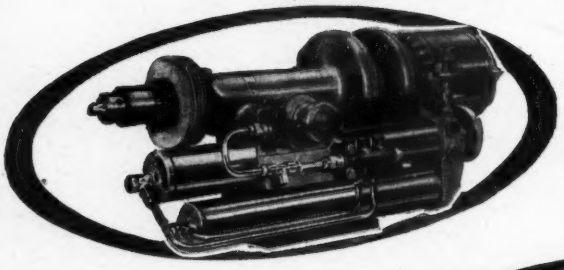


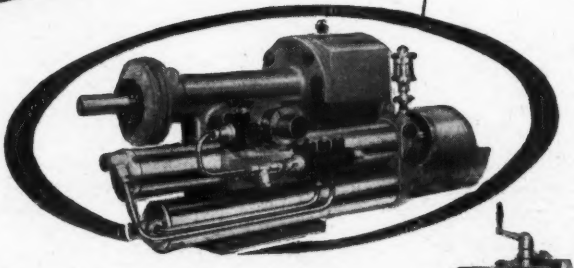


for press button PRODUCTION



MEDDINGS *Pacera*



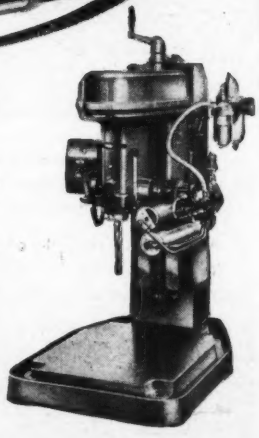


VISIT US ON STAND

6103, HALL 6

7th European Machine Tool Exhibition, Brussels, September 3—12

The fitting of Pacera/Maxam Air Hydraulic Feed Units to your Drilling Machines will provide automatic, effortless operation, and in many cases will enable one Operator to control two, or even three machines—he has only to load and unload the fixtures. Drilling Machines complete with Feed Units are available from a comprehensive range to meet your particular requirements. Unit drilling and tapping Heads of ¼" and ½" capacity at reasonable cost now enable you to introduce press-button efficiency in your production line. Why not obtain full details *now* — *Write to the Manufacturers*



W. J. MEDDINGS LIMITED

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Phone: Slough 26761 (5 lines)

For BORING to close tolerances

ROLLS-ROYCE use

SWISS

DIXI

HORIZONTAL OPTICAL JIG BORERS

STAND 6101
HALL 6
7th European Machine Tool Exhibition Brussels

Experimental Compressor Shaft mounted on DIXI circular table, boring fine limit blade pin holes. Maximum tolerance on finish: 16 micro inches.

BRIEF SPECIFICATION	DIXI 60	DIXI 75
Table size	28 3/4" × 32 5/8"	39 3/8" x 32"
Spindle speeds	34 to 1400 r.p.m.	32 to 225 and 225 to 1600 r.p.m.
Spindle dia.	2 3/8"	3"

Write for illustrated brochure M/238 to Sole U.K. Distributors

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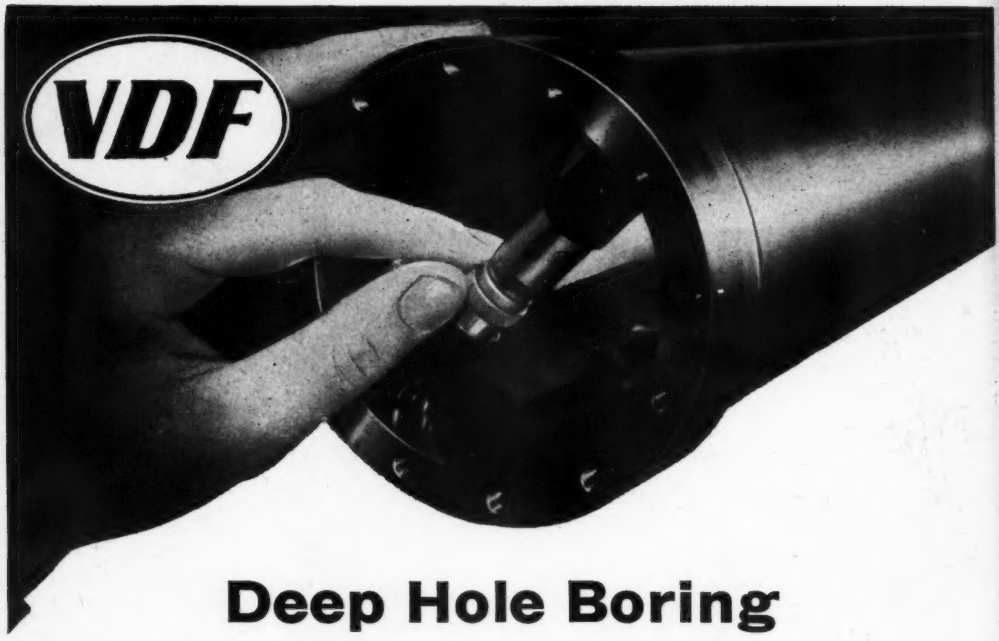
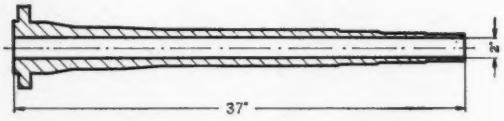
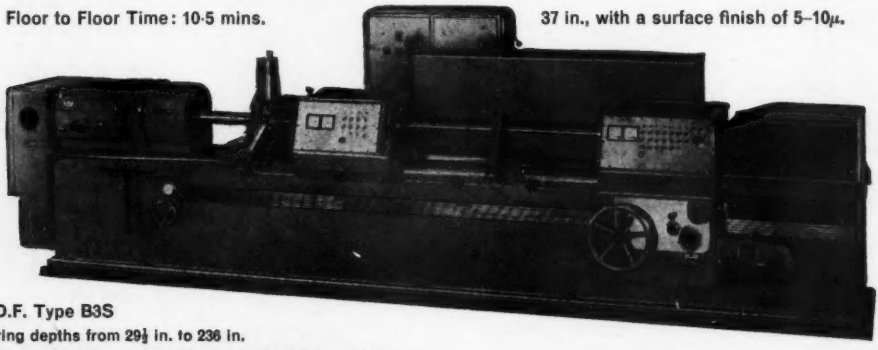


Deep Hole Boring



- Spindle Speed: 710 R.P.M.
- Feed Rate: ·0063 in./rev. ■ Material: EN 9.
- Floor to Floor Time: 10·5 mins.

The work spindle illustrated is machined on a V.D.F. Deep Hole Boring Machine using the solid boring method and central chip disposal. The maximum axial deviation is ·0039 in. over the length of 37 in., with a surface finish of 5–10μ.



V.D.F. Type B3S
Boring depths from 29½ in. to 236 in.
Other models up to a maximum boring depth of 40 ft. and 16 in. dia.

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SYKES MACHINE TOOL COMPANY LIMITED

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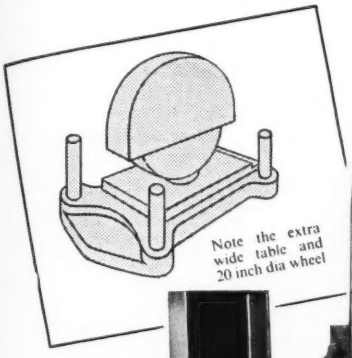
DIE GRINDING

without removing guide pillars



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BUILT

THOMPSON

SURFACE GRINDER

various sizes available for early delivery

Fitted with the *EXCLUSIVE* **HYDRA-COOL HYDRAULIC SYSTEM for *Constant* accuracy**

Developed to grind dies without removing steel sections and guide pillars. 20 inch diameter wheel and extra wide table accommodates all general die work. Feed combinations ensure a fine finish and lengthen die life. Send for full details.

ROCKWELL MACHINE TOOL CO. LTD.

For further particulars write or telephone TODAY

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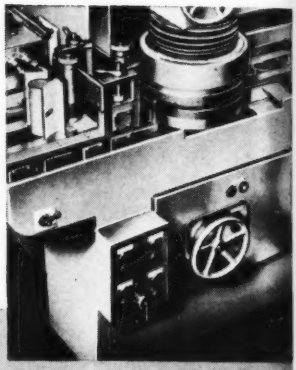
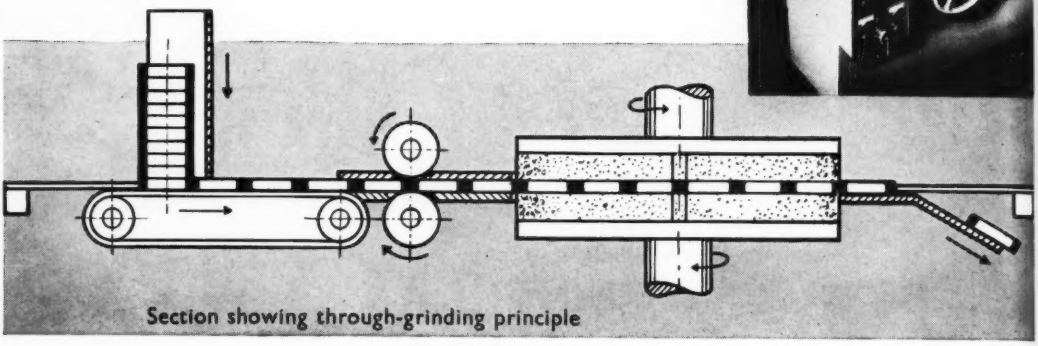
TWIN SPINDLE

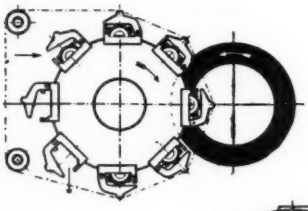
DISKUS

Surface Grinding Machines

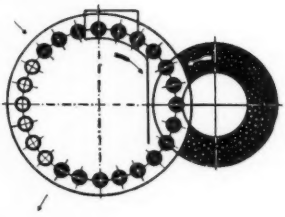




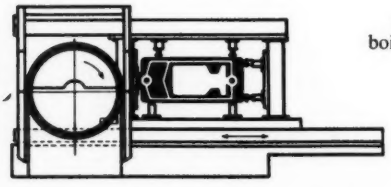
Section showing through-grinding principle



Rotating workholding fixture



Grinding of free workpieces in rotating fixture



Grinding of boiler members

Simultaneous Double-Sided Grinding—With and Without Fixtures

Diskus manufacture a wide range of twin spindle surface grinders for the fast and accurate grinding of workpieces from circlips to large boiler members. If you produce in quantity components with parallel ground faces, please send us details and we will be glad to submit a full quotation for a suitable machine.

ROCKWELL
MACHINE TOOL CO. LTD.

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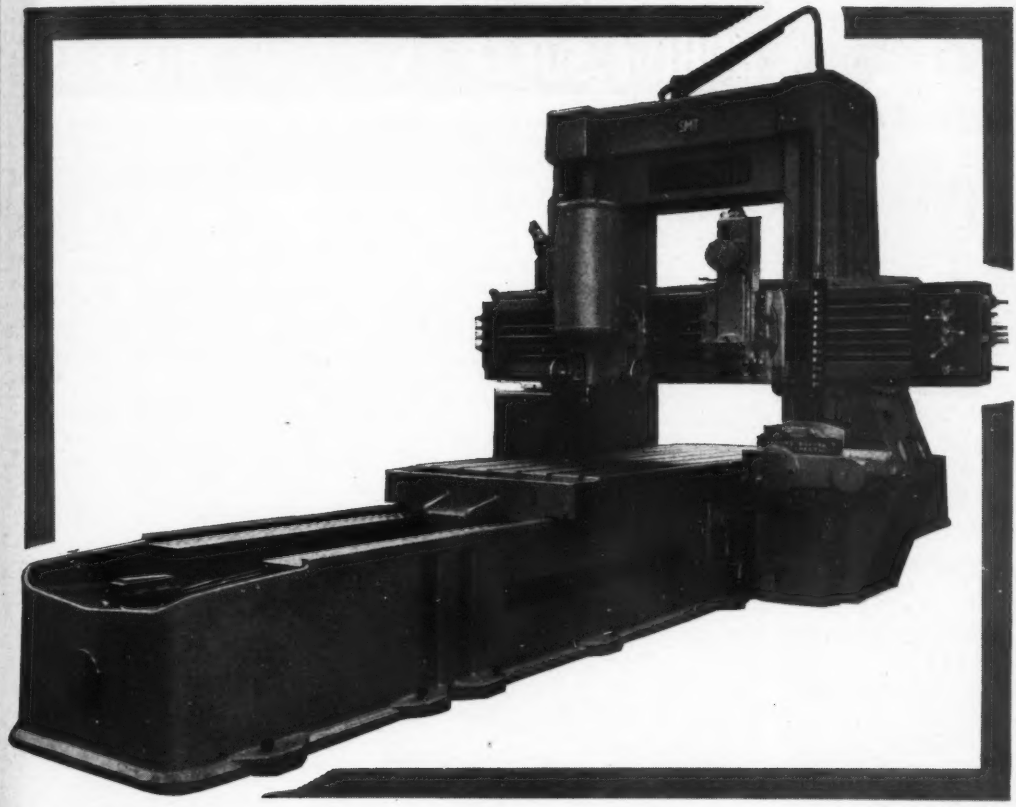

CLYDE BUILT SMT GLASGOW MACHINE TOOLS

DOUBLE HOUSING PLANERS

The illustration shows our new design of 4ft. 0in. Machine complete with Milling Head. These machines are made from 3ft. 0in. wide up to the very largest sizes. Openside, rail and horizontal and vertical machines are also available.

The drive of our Planers now incorporates the closed loop system of control, giving an extremely wide range of speeds and greatly improved acceleration and deceleration, with subsequent reduction in cycle times. The very robust construction of the Machine will be noted, enabling full advantage to be taken of the power available and the latest types of cutting tools. The table runs on plastic strips of proved efficiency. Extra long down feed, with individual feed motion to each tool box is a useful feature and push button controlled inching saves setting time.

Our two-speed milling head is a very useful addition to the Machine, which can be supplied when required, and extremely high metal removal rates are possible, using a very advanced, but easily maintained, type of cutter. We are able to offer these heads for attachment to existing Planers, and in these cases we can also supply the feed gear which may be needed. In the case of our new Machines, the planer drive itself can provide suitable speeds and larger Machines have an auxiliary feed gear in the transverse direction. Leaflets are available of the Planing Machines and the Milling Head, and we shall be pleased to send copies of these publications or to submit quotations at your request.

SCOTTISH

MACHINE TOOL CORPORATION LTD.

17 Lynedoch Cresc., Glasgow, C.3.
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LEEDS 25250

SLIDING RAM GIVES 27½in. AUTO CROSS FEED

HEAVY DUTY MILLING

ANGULAR COMPOUND HORIZONTAL VERTICAL

HURON SUPER UNIVERSAL MILLERS

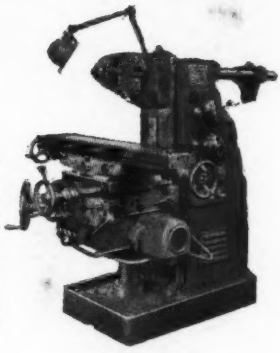
Integral double swivelling universal head provided with 27½in. automatic cross feed by the sliding ram, can be set to the horizontal or vertical position, or to any angle instantaneously—permits the heaviest production cuts. Heads can be retracted completely from table line. 27 spindle speeds from 30 to 2,066 r.p.m., 27 feeds from $\frac{1}{16}$in. to 30in. Rapid traverses in all directions. All operating controls duplicated. Table slides directly in the knee without cross movement or swivel. Double guides of knee permit components in excess of 1½ tons to be machined. The double swivelling universal head requires an opening of only 14in. to enter work pieces and the whole sliding ram with its 27½in. automatic cross movement needs only 18in. clearance. OPTIONAL EXTRA FEATURES: Mounted spacing casting assemblies providing additional 8in. capacity under spindle. 26in. wide 8 T-slot tables and 39½in. automatic cross feed of sliding ram with special heavy duty knee and front operating position.

Type	Table	Automatic Feeds Long	Cross	Vert.
KU4	56½in. × 15½in.	43½in.	27½in.	19½in.
KU5	64½in. × 15½in.	51½in.	27½in.	19½in.
KU6	78½in. × 16½in.	59in.	27½in.	19½in.
KU55	64½in. × 26in.	51½in.	38½in.	18½in.
L83	157in. × 59in.	118in.	39½in.	59in.

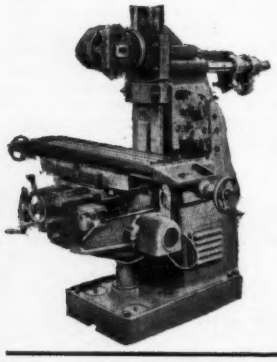
Type 'L' Open-side Traversing Head Universal Miller will mill, bore, slot and drill the largest work-pieces at one setting. The unique design permits greatest variety of operation on large work-pieces; the component remains stationary on the large work-table. Upright slides full length of base table and the sliding ram moves vertically and horizontally.

DUFOUR UNIVERSAL MILLERS

WITH DOUBLE UNIVERSAL SWIVELLING HEAD, RETRACTABLE SLIDE BRACKET AND SPACING CASTING GIVING 26" DAYLIGHT ON No. 59 AND 21" ON No. 61



FOR ALL MODELS Direct reading dial change for speeds and feeds. All parts subject to wear hardened and ground and completely interchangeable. Built to closest tolerances. Rapid traverses in all directions. Table swivels 30°. No. 40 taper for main horizontal spindle, double swivelling universal head, dividing head and rotary table. Hardened and ground centre guide for slideways. Twin overarms. Double swivelling sliding spindle heads with speeds 53-3000 r.p.m. Double swivelling universal head on retractable slide bracket providing with 5½in. Spacing Casting Drive assembly on 59 Machine 26in. daylight, and 21in. on No. 61.



MODELS 53 & 61. 16 universal head spindle speeds 21-1600 r.p.m.; 8 horizontal spindle speeds 21-1180 r.p.m.; 8 automatic feeds ½-18¾in.

MODEL 59. 36 universal head spindle speeds 14-1780 r.p.m.; 12 horizontal spindle speeds 21-1180 r.p.m.; 16 automatic feeds ½-20in.

MODEL 54. Automatic cross feed of universal head 20in.; 18 universal head spindle speeds 12-1500 r.p.m.; 36 horizontal spindle speeds 6-1500 r.p.m.; 18 automatic feeds $\frac{1}{16}$-23½in.

Type	Table	Automatic Feeds Long.	Cross	Vert.
53	43½in. × 9½in.	27½in.	9½in.	15½in.
61	47½in. × 10½in.	30½in.	9½in.	15½in.
59	51½in. × 11½in.	34½in.	11 11/16in.	21½in.
54	67in. × 14½in.	43½in.	14½in.	20½in.

EUROPEAN MACHINE TOOL EXHIBITION, BRUSSELS
SEPTEMBER 3—12, 1961

We look forward to demonstrating these machines to you on STAND 9119, Hall 9; and STAND 6119, Hall 6

Send for full particulars of our very extensive range of these machines; ask for demonstration

Rudolph Carne & Co. Ltd. SWAN WORKS, FISHERS LANE, CHISWICK, LONDON, W.4.

Tel. CHISWICK 0514, 6585 & 0337. Inland Telegrams: RUDCAR, CHISK, LONDON. Overseas Telegrams: RUDCAR, LONDON, W.4.

TAPE CONTROLLED DRILLING

Look at these advantages

on a Wadkin type TCD1

No Marking Out

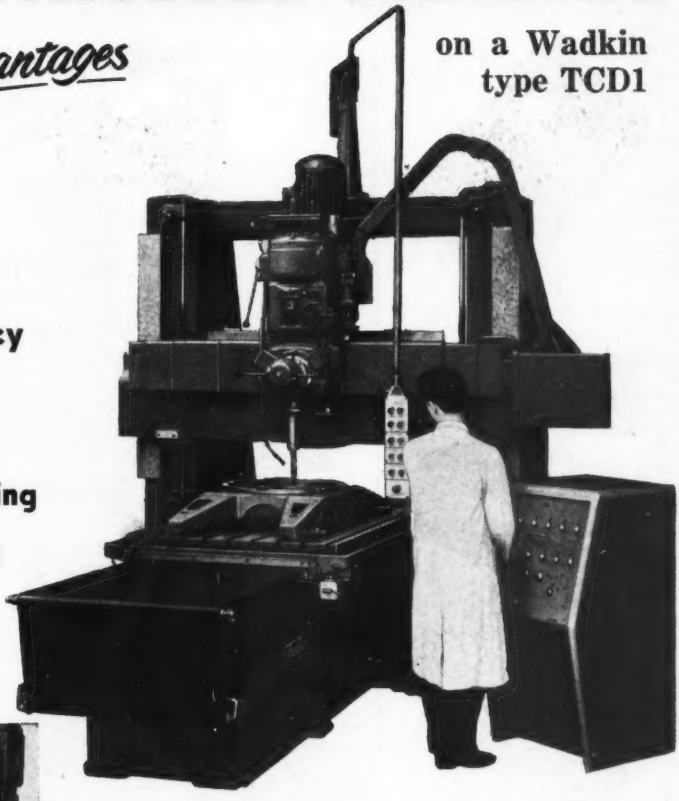
No Drilling Jigs

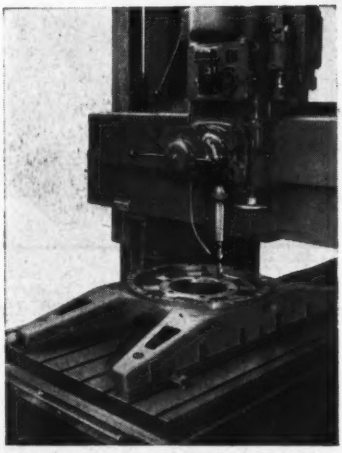
Positional Accuracy to ±·001"

Fully Automatic

Tape or Dial Setting

Reasonably Priced





Wadkin Tape Controlled Drilling Machine drilling a cast-iron rotating slideway.

This machine will accurately position holes up to 2in. diameter in steel. It eliminates all marking off as well as the necessity of using drilling fixtures. Once the tape has been punched — a relatively simple operation — exact repetitions of even the most complicated drilling jobs are guaranteed at any time.

The rigidity of the machine enables maximum diameter drills to be fed directly into steel without the break-through problem normally experienced.

The price of this machine, complete with positioning control system, compares favourably with a conventional drilling machine of the same capacity.

May we send you more details?

Wadkin

SPECIALISTS IN HIGH SPEED MACHINE TOOLS

Wadkin Ltd., Green Lane Works, Leicester. Tel: 68151. London Office: 62 Brook St., W.1. Tel: MAYfair 7048

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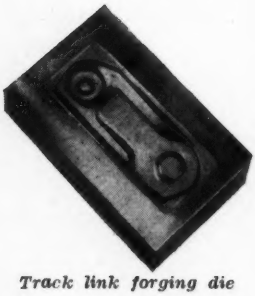
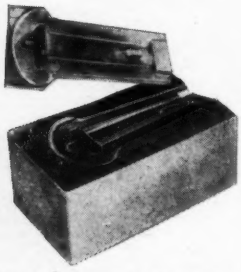
Versatile, reliable, accurate



Track link forging die

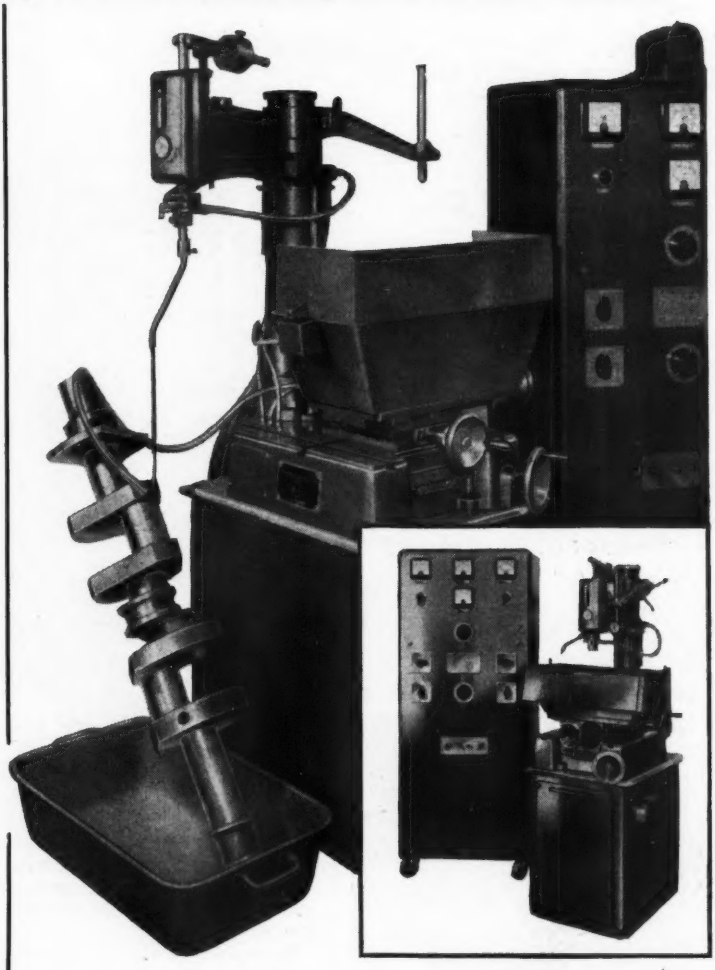


Compressor blade die

Brass stamping die

Die casting mould

Some examples of the types of dies now being produced with Sparcatron equipment.



A typical example of the versatility of the standard MK.IIIA Sparcatron Die Making Machine with the head swung to the side removing the broken drill from a large crankshaft too big to be accommodated in the table tank.

IDP SPARCATRON

IMPREGNATED DIAMOND PRODUCTS LTD.
(No. 2 Factory) Gloucester, England

When answering advertisements kindly mention MACHINERY.

announcing the MOORE NO. 1½ JIG BORER

ALL THE FEATURES OF THE No. 1...

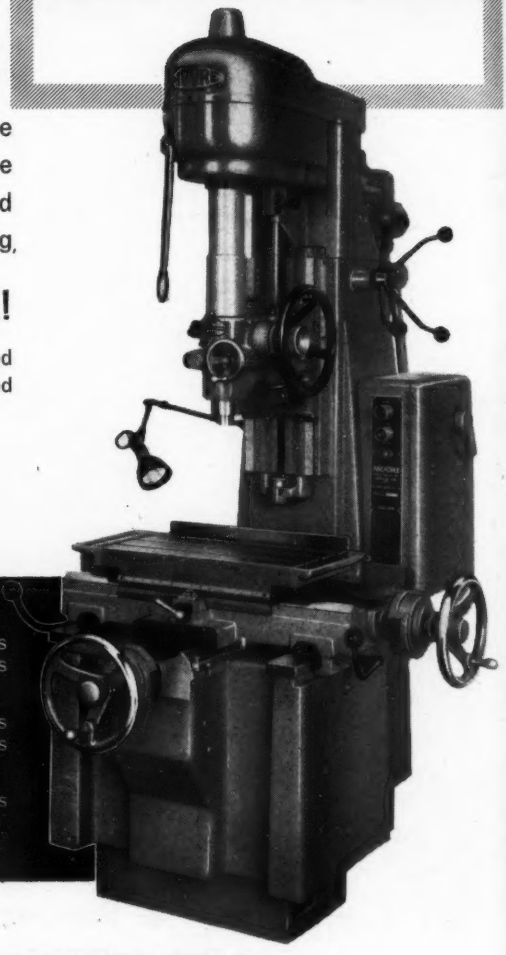
Plus

- 10½" x 19½" Table Surface
- 2 Feeds instead of one
- Variable Spindle Speed
- No Gibs, No Overhang,

...AT A POPULAR PRICE!

This is the logical successor to the renowned Model 1, a robust precision tool engineered for long life accuracy.

Check tolerances — and price!



check these figures...

LONGITUDINAL TRAVEL:	
Greatest error in any inch	30 millionths
Greatest error in 14 inches	90 millionths
CROSS TRAVEL:	
Greatest error in any inch	30 millionths
Greatest error in 9 inches	90 millionths
SQUARENESS:	
Compound slide (full travel)	75 millionths
Travel, spindle housing	90 millionths in 9
Travel, spindle	90 millionths in 3"

*and for checking—

The **MOORE** UNIVERSAL MEASURING MACHINE

CATMUR MACHINE TOOL CORPORATION LIMITED

103 Lancaster Road, Ladbroke Grove, London, W.11. 'Phone PARk 9451/2

Up-to-date planing with machines of precision and sturdiness

CARNAGHI

Features include:—

- Robust construction throughout
- Massive and rigid bed
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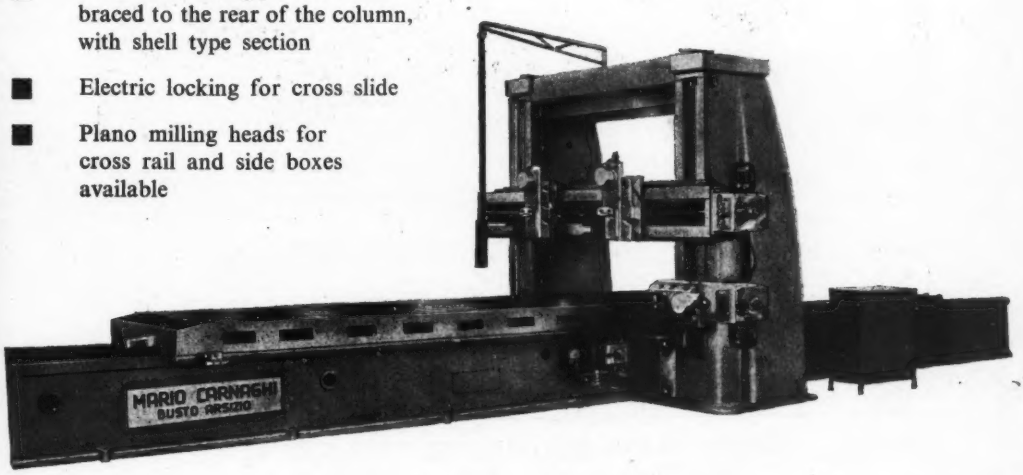
- Cross rail strongly ribbed and braced to the rear of the column, with shell type section
- Electric locking for cross slide
- Plano milling heads for cross rail and side boxes available

Can be supplied with Electro magnetic clutch drive, Ward Leonard or hydraulic



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Canal Street Works, Nottingham. Tel. 51891 (4 lines) Grams. TOOLS NOTTINGHAM

The SICMATIC

puts small batches into the mass production range

HYDRAULIC PROFILING AND COPYING LATHES

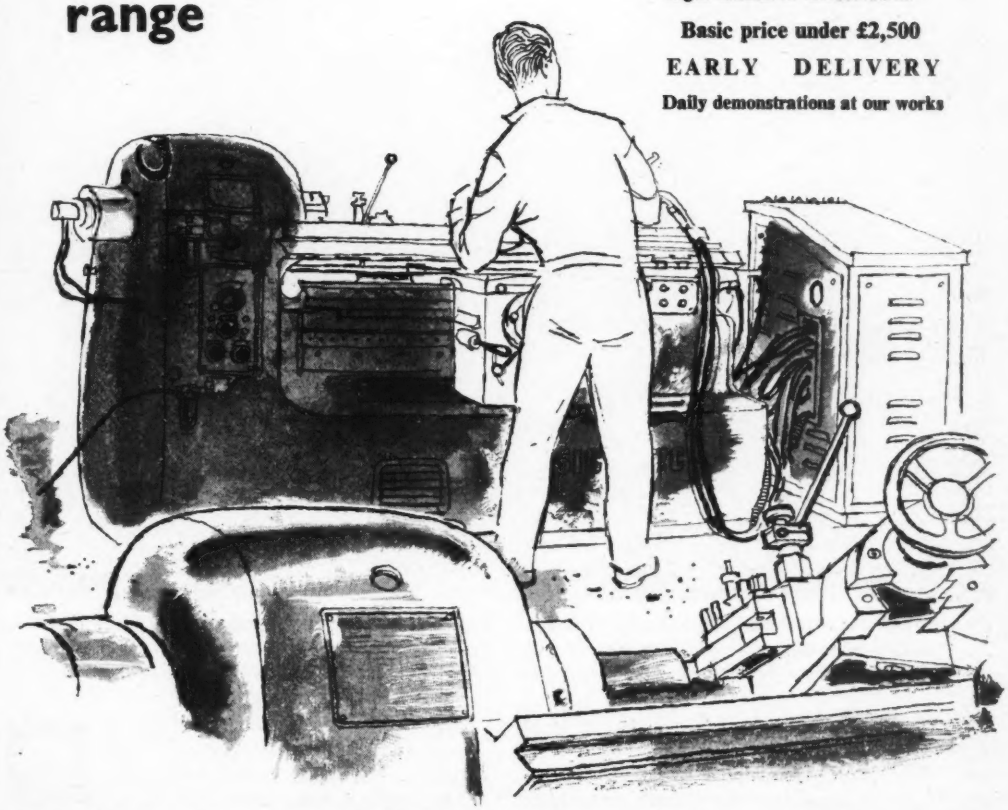
FEATURES INCLUDE:

1 Capacity 14in. by 27in.
2 Duplomatic Hydraulic System.
3 Hardened Bed Slideways.
4 Auto cycling up to six depths of cut.
5 Hydraulic tailstock for drilling and boring.
6 Uses template or existing component.
7 Eight models to choose from.

Basic price under £2,500

EARLY DELIVERY

Daily demonstrations at our works



HERBERT WIDDOWSON & SONS LTD

Canal Street Works, Nottingham. Tel: 51891 (4 lines). Grams: TOOLS NOTTINGHAM

Shell demonstration

Two clean, bright pennies are placed in beakers of oil, of equal performance level, one Shell Garia Oil 21, the other a conventional cutting oil containing sulphurised additives. After three hours at room temperature one penny is still bright and stain-free, the other heavily stained with black copper sulphide. The bright penny is from the beaker containing Shell Garia Oil 21, the blackened one from that containing the conventional oil. While these were just pennies they could have been bronze bushes in your machine tools—stained in less than half a shift. Sulphur is essential in heavy-duty cutting oils. Special additives in Shell Cutting Oils protect your machine tools and yet allow the sulphur to do its job.

Write for the book "Selecting Your Cutting Oils" to Lubricants Department, Shell-Mex House, London, W.C.2.

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SHELL

SHELL CUTTING OILS

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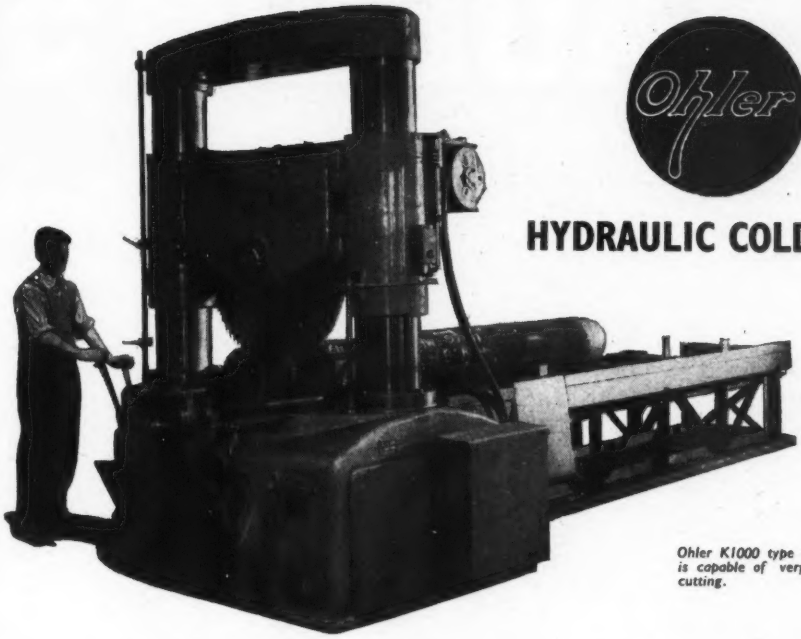


Ohler

HYDRAULIC COLD SAWS

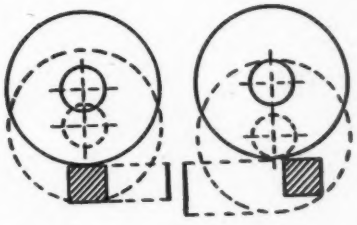
Ohler K1000 type machine which is capable of very heavy duty cutting.

for high speed, heavy duty and long saw blade life,

Ohler saw segments are firmly attached to the saw body by four rivets. Extra deep tongue and groove joint increases the strength and rigidity.

Ohler Cold Saws are built to an extremely rigid frame design and work is held in a hydraulic vice immediately below the centre of the saw blade, resulting in the shortest cutting distance and minimum cutting time. The extremely efficient supply of coolant enables high cutting speeds to be employed and the long life of Ohler Segmental Saw Blades together with the simplicity of change-over ensures maximum production from the machine. Hydraulic feed to the saw head is infinitely adjustable and on the K1000 machine illustrated above, six saw blade speeds are provided.

Ohler Hydraulic Cold Saws are built in three sizes and models with automatic hydraulic stock feed to pre-set length are available. Write today for details.



SHORT CUT—workpiece below centre of saw blade.

LONG CUT—workpiece outside the centre of saw blade.

Workpieces are centred below the saw blade on the Ohler machine as shown in the left-hand example above. This ensures the shortest cutting traverse and minimum cutting time.

Sales and Service for the British Isles

DRUMMOND-ASQUITH LIMITED

Member of the Asquith Machine Tool Corporation

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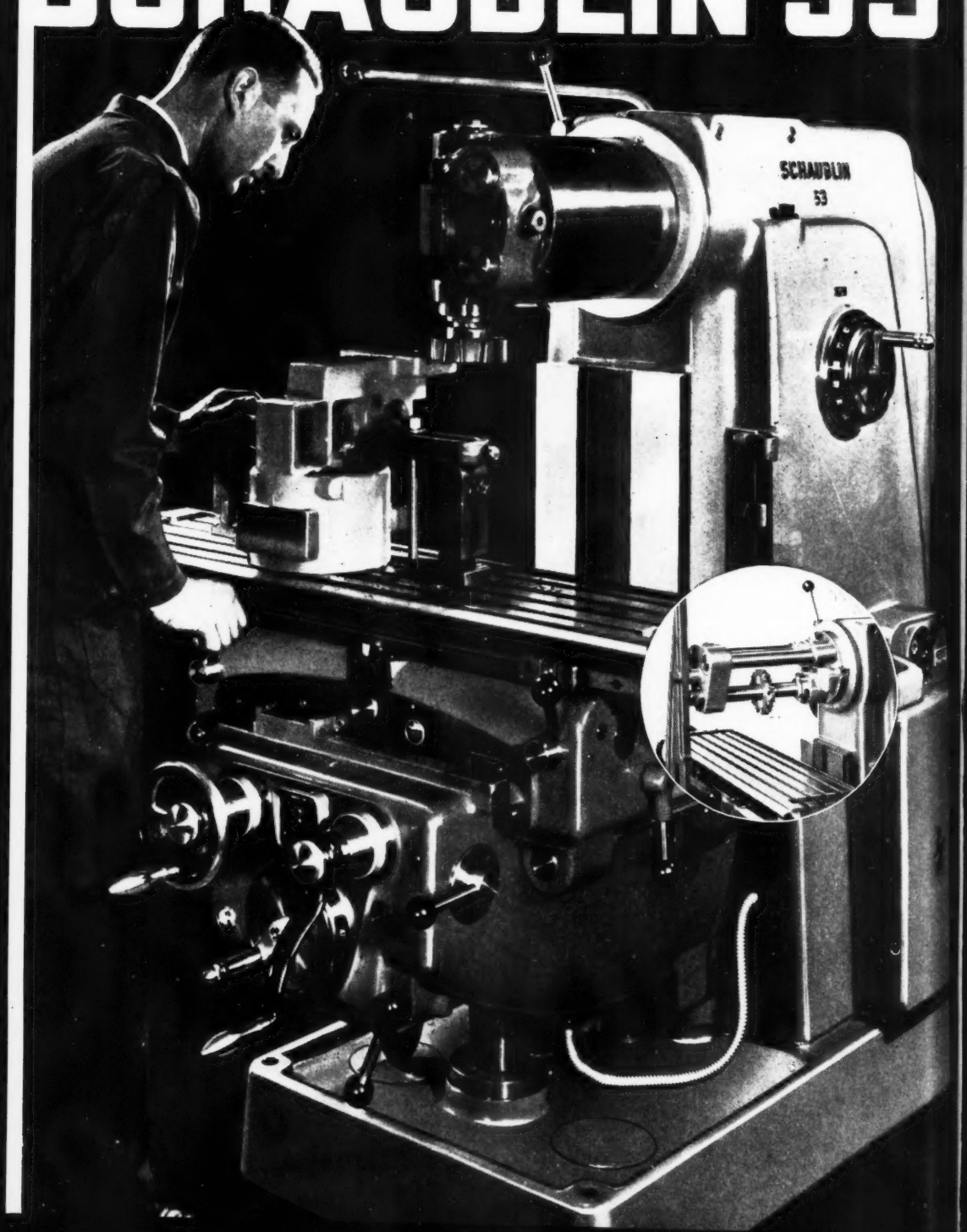
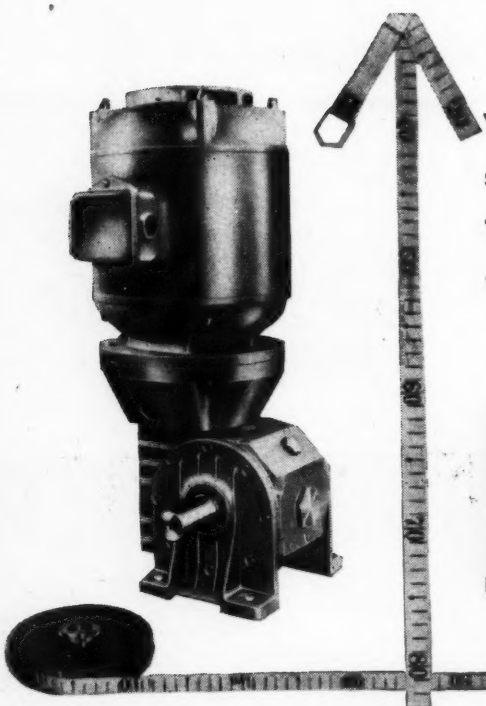
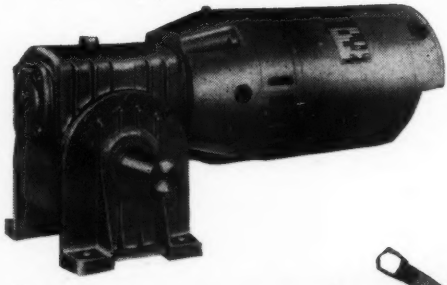
IF 354

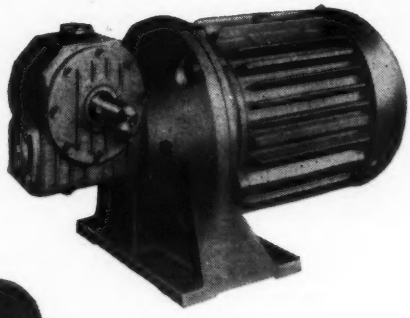
SCHAUBLIN 53





Vertical or horizontal
streamlined or functional
THE INCREDIBLY VERSATILE VERSO





This new Holroyd 2¼" centres worm gear speed reducer has been designed to meet the need for a self-contained motorised drive suitable for continuous use, and one which will look right in any surroundings. No matter what the application, it is possible to select from its variety of assemblies and mounting positions, an arrangement which makes it appear an integral part of the surrounding machinery, and *not* an added afterthought.

VERTICAL OR HORIZONTAL
STREAMLINED OR FUNCTIONAL
THE VERSO
FITS YOUR PLANS PERFECTLY

The Verso has all the famous features of Holroyd reliability and high efficiency. Centrifugally cast Holfos wormwheel; case-hardened and profile ground alloy steel worm; ball bearings throughout; rigid cast iron casing and oil bath lubrication requiring no attention over long periods. Output speeds are from 14 to 300 rpm. Output torques up to 750 lb. ins. Standard motors from ¼ up to 2 hp.

Please write for catalogue V.60 which gives further technical information.

Holroyd

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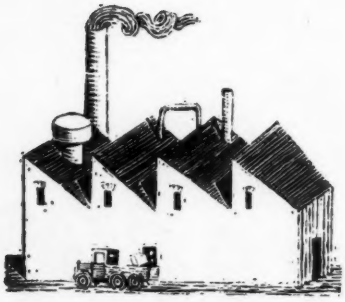

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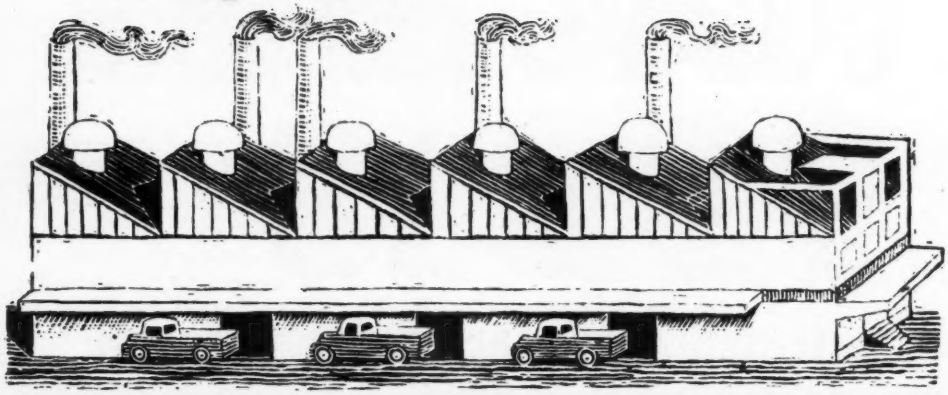

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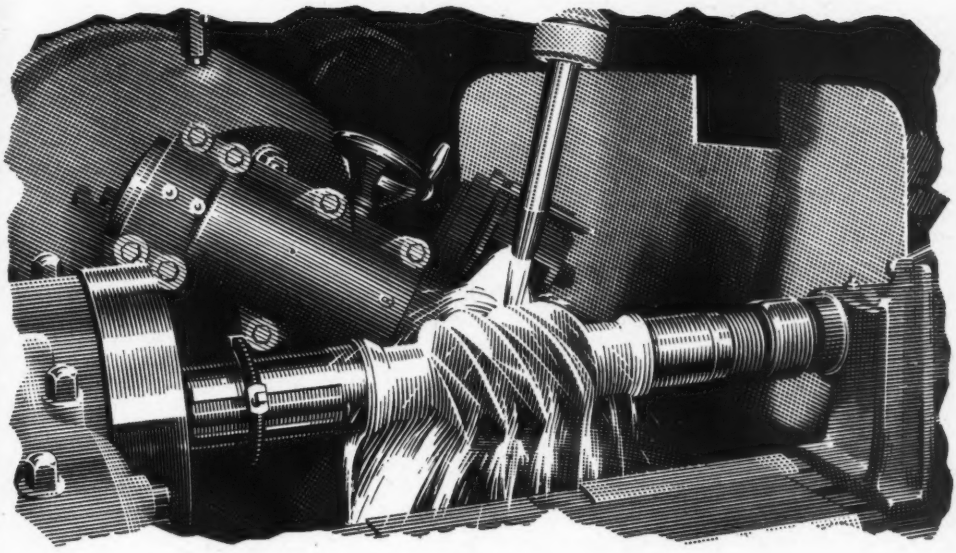

How good is a cutting fluid?

That's a very pertinent question to ask right at the start. Advisedly so, for we hold strong views about the part cutting fluids can and do play in the machining of metals. For far too many years, it has been pre-supposed that as long as you flooded the tool and workpiece with a fluid of some kind, things were bound to happen! Just what fluid seemed rather unimportant and one might be considered a niggler if one held a more rigid viewpoint. But have the bad old days really gone for good—the good of metal cutting that is? All too often, a tooling set-up gets every kind of intelligent consideration until it comes to the question of coolant. The nearest drum or central bulk supply may be alright but could be just the opposite. A cutting fluid has a major responsibility in the province of machining and forming metals and it is our fondest tenet that until you have the right oil on tap, you are missing the sort of production savings that Fletcher Miller users secure. After 45 years, we have a lot of accumulated know-how (sorry about that word) and just the right cutting fluid for any metal production job. Call in the experts.

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FLETCHER MILLER *cutting fluids*

FLETCHER MILLER LTD., HYDE, CHESHIRE
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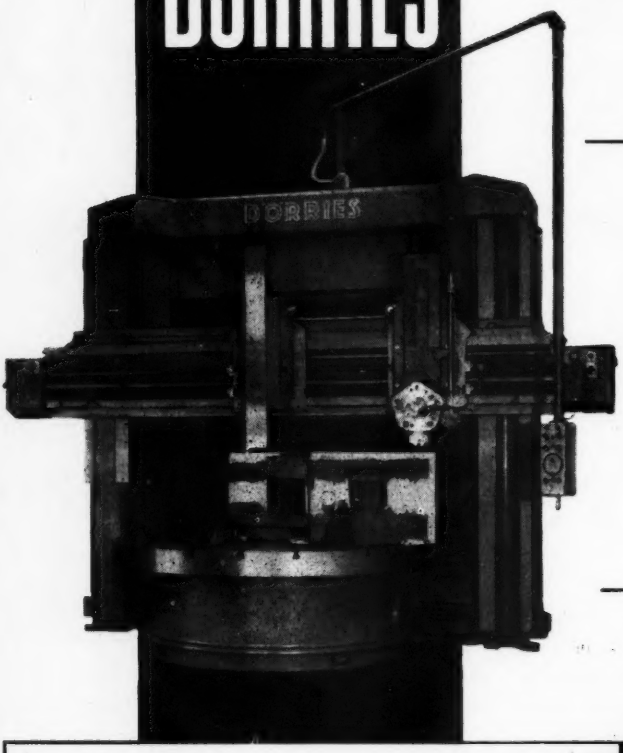
CF 138

DÖRRIES Vertical Turning & Boring Mills



HEAVY DUTY MODEL SD280

Reduced idle time, push-button setting, rapid feed change and simplified control. Feeds and speeds can be changed with table operating.

SPECIFICATION

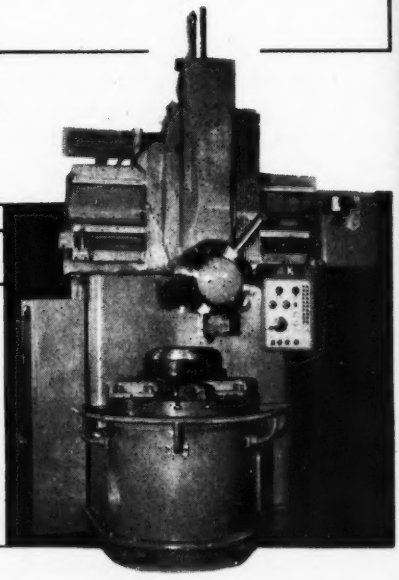
Max. turning diameter	138in.
Table diameter	110in.
Max. height under cross rail	67in.
Table speeds (24) 2-100 r.p.m.	
Main motor 60 h.p.	

MODEL SD80 with PROGRAMME CONTROL...

Tables of all machines are mounted on large angular and special thrust bearings. This ensures a high concentricity accuracy giving a table rotation concentricity of .00012in., permitting a grinding head to be fitted on the cross rail. Feeds and rapid traverses are interlocked and all gears are protected against overload.

SPECIFICATION

Max. turning diameter	40in.
Table diameter	32in.
Max. height under cross rail	28in.
Table speeds (24) 7-355 r.p.m.	
Main motor 32 h.p.	



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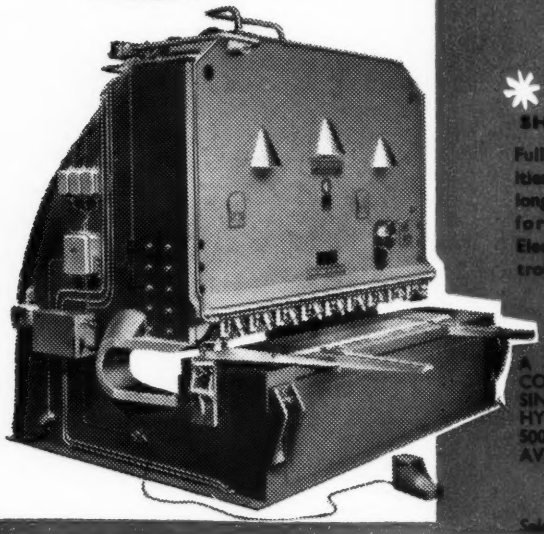
PRESS BRAKES

Standard sizes up to 750 tons pressure. Infinitely variable speed of stroke and pressure with electro-hydraulic remote control.



HYDRAULIC
GUILLOTINE SHEARING MACHINES

Full range of sizes with capacities up to 1¼" thick by 20 ft. long. Adjustable cutting angle for varying thicknesses. Electro-hydraulic remote control. Bevel cutting equipment.

A RANGE OF DOUBLE COLUMN OPEN FRAME AND SINGLE PISTON OPEN-SIDED HYDRAULIC PRESSES UP TO 500 TONS CAPACITY IS AVAILABLE.

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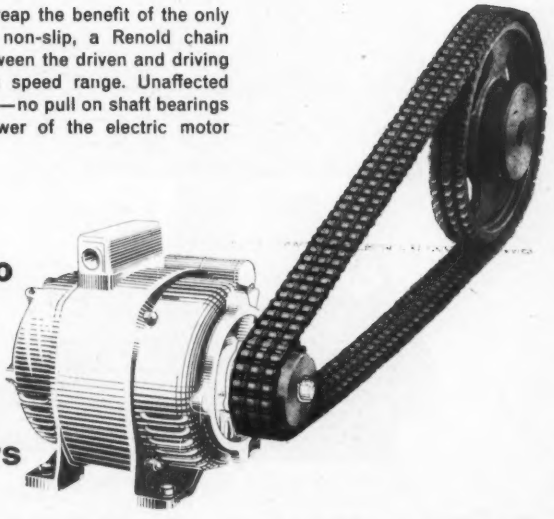
A

A perfect team

For successful racing of a motorcycle combination teamwork is essential. Both rider and passenger must work in unison—at high speeds a wrong movement by either could put them out of the running.

Team your electric motor with a Renold chain and reap the benefit of the only drive with 98½% proved efficiency. Compact and non-slip, a Renold chain drive preserves a definite ratio and relationship between the driven and driving shafts and maintains its efficiency throughout its speed range. Unaffected by atmospheric conditions, there is no initial tension—no pull on shaft bearings—and it is available for transmitting the full power of the electric motor immediately on starting up.

RENOLD chains go with electric motors



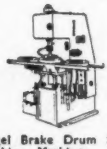
RENOLD CHAINS LIMITED • MANCHESTER

NAGEL

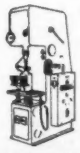
HONING

MAKES RUNNING PARTS RUN BETTER

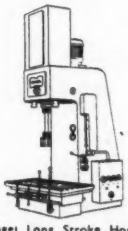
Nagel Horizontal Honing Machine. Capacity from ⅜" to 2½" dia. bores



Nagel Brake Drum Superfinishing Machine. Automatic work cycle with hydraulic clamping.



Nagel VM Type High Duty Machine especially suitable for hard-chromed components.



Nagel Long Stroke Honing Machine. Strokes from 24" to 48" with capacity from 1¼" to 20" dia. bores.

Honing of close-limit components eliminates heavy initial wear, and allows closer tolerances, thus increasing considerably the reliability and performance of all classes of product on which honing is used.

Superfinishing of internal and external surfaces can be carried out on a mass-production basis using Nagel Honing Machines—with the added advantage of automatic cycle operation on certain machines.

Mass production of honed components to the highest limits of accuracy can be obtained by using the Nagel Automatic Cycle double-spindle machine complete with Special Nagel Sizing Equipment.

A high level of production is also possible, however, with the push-button controlled single spindle machines which incorporate the special Nagel features of infinitely variable hydraulic operation of all movements of the machine, including tool adjustment and speed.

A leaflet is available from :—

WICKMAN LIMITED

FACTORED MACHINE DIVISION, BANNER LANE, COVENTRY
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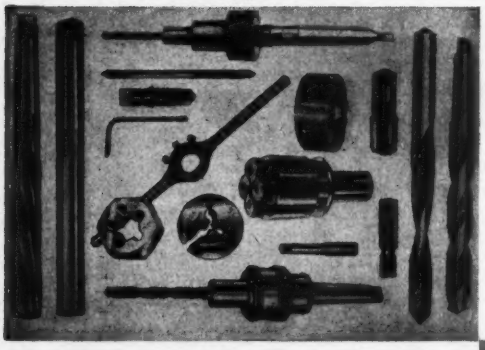
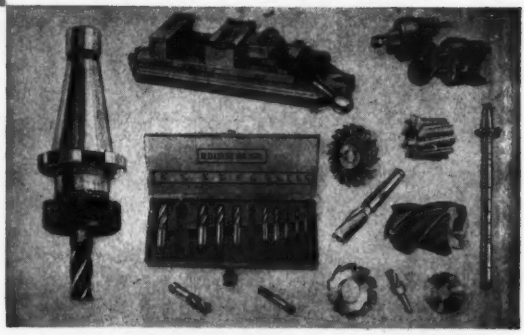


supreme

B·S·A



Milling cutters, twist drills, reamers, taps and dies, dieheads, tapping attachments, screwed shank tools and chucks, thread rolling dies, drill chucks, drill holders and adaptors, arbors, oil and suds pumps, machine vices, lathe chucks, magnetic chucks and equipment, hacksaw blades, broaches, limit switches.

B.S.A high speed tapping attachments. A quick easy pre-setting ensures correct tap-driving pressure with reserve elasticity to relieve the tap of extreme stresses should it encounter an obstruction, thus preventing tap breakage. Three sizes utilise standard hand taps in the range $\frac{1}{4}$" BSF to $1\frac{1}{4}$" W., and two versions for capstan and turret lathes, $\frac{1}{4}$" to 1".

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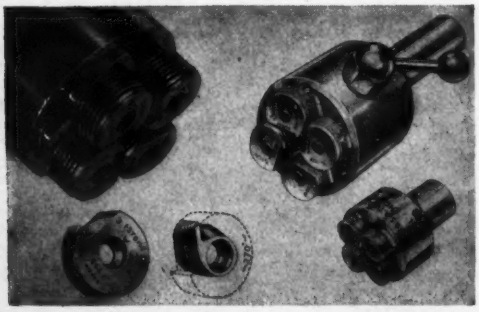
variety and quality



B.S.A. SMALL TOOLS LIMITED
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Cables: MADRICUT BIRMINGHAM TELEX 33-451

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BURTON GRIFFITHS & CO. LTD.
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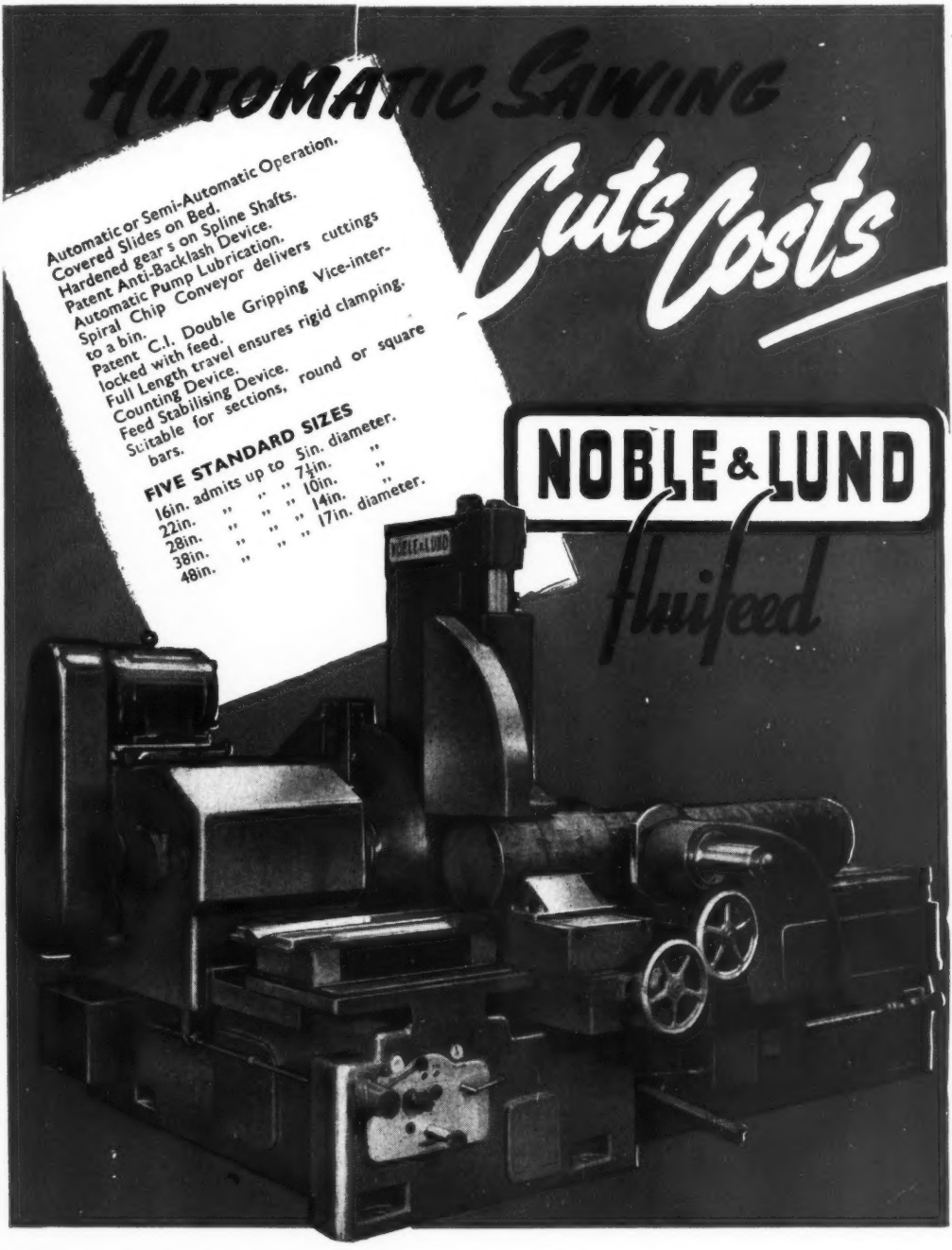

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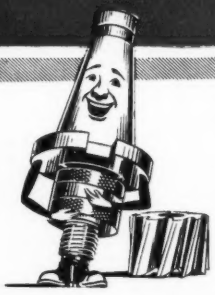

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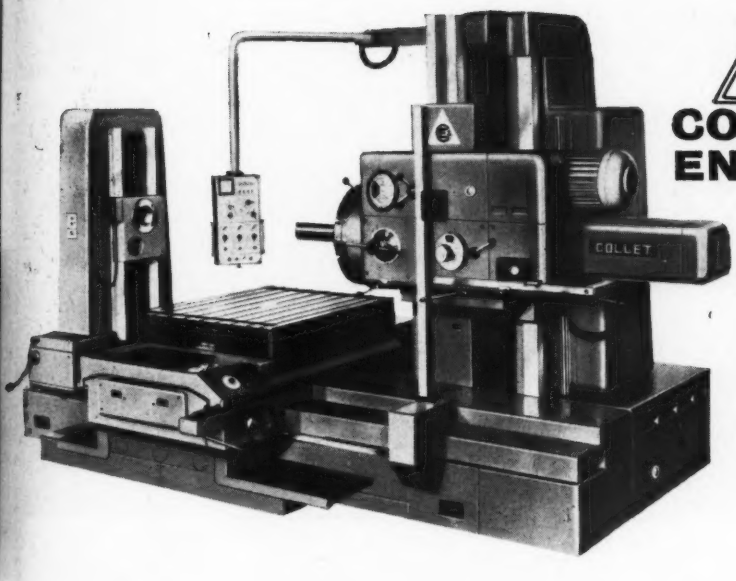

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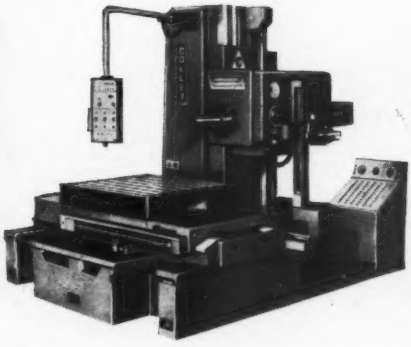

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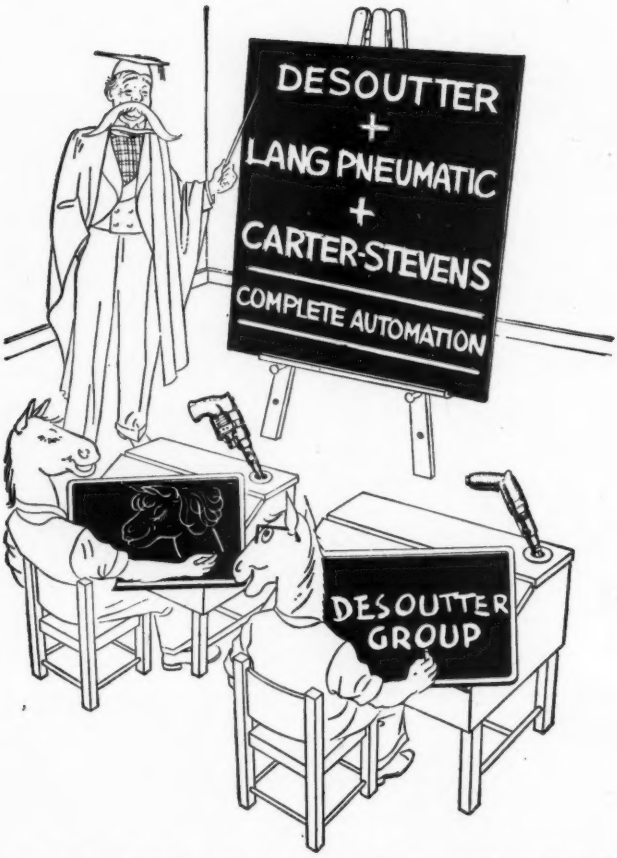

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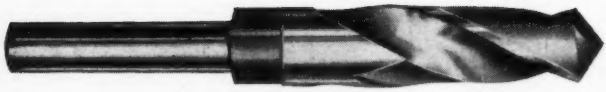

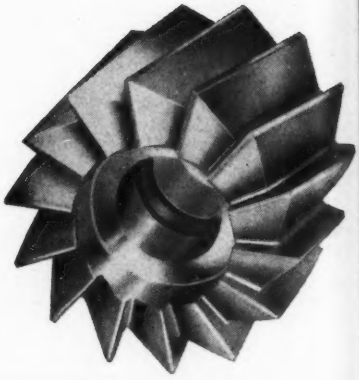

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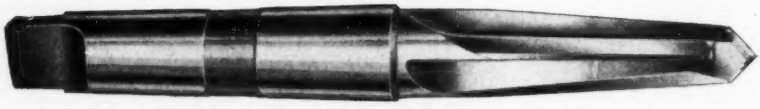

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Abstracts of Principal Articles

Making Plates for Data Processing Machines P. 236

In addition to the " banks " of presses employed for the production of printing plates from zinc blanks, Adrema, Ltd., Acton, have developed a multi-stage press tool for making aluminium plates, used on certain of their Bradma data processing machines. The sequence of operations is similar to that employed for zinc plates but the blanks are cut from coiled strip. Automatic feeding, transfer and stacking arrangements are incorporated, and are operated pneumatically under the control of pilot valves that are actuated by cams on the ends of the main crankshaft. The tool is fitted to a special Ratzer press, which comprises, in effect, two 10-ton units on a common base, with a single crankshaft. With this equipment, printing plates are produced at a rate of 80 per min. (MACHINERY, 99—2/8/61.)

The Production of Hydraulic Pit-props P. 245

In this third and concluding article in a series describing methods employed by Dowty Mining Equipment, Ltd., Ashchurch, Glos., for producing their hydraulic pit-props, typical welding operations, performed on Metropolitan-Vickers automatic machines, by the CO_2 shrouded arc and submerged arc processes, are considered. These examples include the welding of the end-caps and guard-tubes to the outer tubes, and the piston-heads to the inner tubes. The prop assemblies are filled and tested on hydraulic rigs. The checks performed in the production lines are augmented by others, more critical, which are conducted in a well-equipped test-house, on a sample basis. (MACHINERY, 99—2/8/61.)

Barrel-finishing Operations on Bearing Rollers .. .. P. 252

Two barrel-finishing machines built by the Almco Supersheen Division of Great Britain, Ltd., Bury Mead Works, Hitchin, have recently been installed at the East Works of the British Timken Division of the Timken Roller Bearing Co., Daventry, for descaling and polishing heat-treated bearing rollers, in readiness for grinding. The machines are installed adjacent to a heat-treatment furnace, whence they are delivered, and handle rollers at the rate of 40,000 per week, on a continuous 24-hour basis. The rollers are delivered direct to a special unit wherein they are collected and stored in 300-lb. loads, in readiness for barrel-finishing (MACHINERY, 99—2/8/61.)

Producing Accurate Fine-pitch Gears P. 265

For boring 36 holes in a gearbox and cover which houses a gear train associated with missile ground operational equipment, a Pratt & Whitney jig boring machine at the works of the Arma Division of the Bosch-Arma Corporation, N.Y., U.S.A., has been fitted with a special auxiliary table. This table incorporates a retractable plunger, which can be accurately aligned with the machine spindle, and this plunger is engaged successively with holes in the underside of a fixture to which the workpiece is clamped. These holes are arranged in the pattern of the bores to be machined, and with this arrangement it is necessary to make one setting of the machine table only, all other movements being made by the fixture on the auxiliary table. At another set-up, fine-pitch gears are hobbed on a standard Barber & Colman No. 3 machine, with the aid of a special arbor assembly. The accuracy obtained conforms to Class 3 of the A.G.M.A., and no subsequent shaving operation is required. (MACHINERY, 99—2/8/61.)

Some Design Characteristics of the Internal Gear Pair .. .. P. 270

After discussing the various advantages which are offered by internal gears, from the standpoints of load-carrying capacity and compactness, for example, this article deals firstly with the cycloidal internal gear, and its geometry. A particular feature of this type of gearing is the inherent " double contact " which is obtained, and it is suggested that a greater appreciation of this phenomenon might stimulate the search for other profile systems which provide it, but are easier to generate than cycloidal forms. Attention is also paid to involute internal gears, and in particular to the means for ensuring that disengagement interference is avoided. Examples are given of the calculations which require to be made to determine whether any given pair of internal involute gears will fulfil this requirement. A table is included giving pressure angles at tips of teeth for external and internal gears from 6 to 169 teeth. (MACHINERY, 99—2/8/61.)

IN FORTHCOMING ISSUES

Making petrol dispensing pumps—Standardization of machine tools in East Germany—Diaphragm chucking—A quick-acting centrifugal governor.

Contributions to MACHINERY

If you know of a more efficient way of designing a tool, gauge, fixture, or mechanism, machining or forming a metal component, heat treating, plating or enamelling, handling parts or material, building up an assembly, utilizing supplies, or laying out or organizing a department or a factory, send it to the Editor. Short comments upon published articles and letters on subjects concerning the metal-working industries are particularly welcome. Payment will be made for exclusive contributions.

EDITORIAL

Stability of Gauge Blocks

Reference was recently made in MACHINERY to the fact that the metre has now been defined in terms of the wavelength of a radiation of the atom of krypton 86 and that the Weights and Measures (No. 2) Bill will relate the yard to the metre. It follows that in future these two standards of length will be of assured stability, and that complications will no longer arise as a result of minute dimensional changes necessarily associated with physical objects. As has been pointed out, moreover, the adoption of this natural, indestructible, standard has resulted in an important gain in precision, the degree of uncertainty which existed hitherto having been reduced in the ratio of at least 10:1.

For the purpose of precise control of dimensions in the production of many components in metal, however, which is assuming increasing importance as the tolerance margins permitted by designers are progressively reduced, it is essential to have some convenient means of relating measurements made in the machine shop and the inspection room to the ultimate standard. As is well known, slip gauges, which are readily obtainable to various degrees of accuracy, and can be conveniently built up into combinations either for direct measurements or for setting or checking other gauging equipment, provide a very effective means of translation.

It is common practice, of course, to check workshop and inspection gauges periodically against reference sets which are provided for the purpose, and from time to time are submitted to a central laboratory for verification. Hitherto, this procedure has proved very satisfactory, but with the specification of increasingly stringent limits for numerous workpieces, the degree of permanence of slip gauge dimensions is assuming growing importance. These gauges are necessarily made from material of high quality, and their nature or treatment are such as to ensure good resistance to wear and considerable stability. Where the gauges are in regular use, however, some changes in dimensions on account of abrasion must inevitably take place, regardless of their characteristics. Such changes can be anticipated and measured as often as may be deemed desirable, and suitable allowance can then be made.

At the same time, like the material standards that have been—or will be—replaced, slip gauges are subject to small dimensional changes that are not associated with use or wear, and such changes may affect working and reference sets alike. Because of the care taken in their production, the slight instability of slip gauges has not been of any particular significance in the past, but now that it is becoming necessary to control workpiece dimensions within such very small margins of error the situation is changing and more attention is necessarily being paid to this aspect.

As an indication of the nature and magnitude of the problem, attention may be drawn to some figures quoted in a paper entitled "The Development of More Stable Gauge Blocks," by Mr. M. R. Meyerson, Mr. T. R. Young, and Mr. W. R. Ney, which was presented recently to the American Society for Testing Materials. Eleven blocks, purchased more than 30 years ago from a common source, and said to be of the same chemical composition and to have received identical heat and stabilizing treatments, have since been under observation for dimensional stability by the U.S. Bureau of Standards. Some of the blocks have grown progressively over the period by amounts up to 20 micro-inches per inch, others have not varied by more than 2 micro-inches per inch, and the rest "have remained stable or have shrunk slightly for a period of one to seven years and then have proceeded to grow." These tests, and subsequent analyses, have made it clear that there may be considerable differences in stability with apparently very small variations in composition or treatment, and that stability cannot adequately be judged on the basis of short-term observations.

An extensive investigation is now in progress for the purpose of selecting a material and treatment that will ensure improved and more consistent stability, the problem being complicated by the wide choice that is available in both respects. In this connection it may be noted that the current work involves a total of 16 materials and 42 different treatments. The aim is to obtain gauge blocks which will not change in dimensions by more than 0·2 micro-inch per inch per year, and it is reported that promising preliminary results have been obtained with certain material/treatment combinations. Thus, blocks of 410 stainless steel, subjected to a 2-stage nitriding process, proved to be stable within the limit mentioned over a period of one year. It was also noted that certain through-hardened blocks of a modified 52100 steel, after being relatively unstable for the first six months, subsequently changed in dimensions at the rate of only 0·1 micro-inch per inch per year. As has been

(*Continued on page* 283)

Making Plates for Data Processing Machines

Methods and Tooling Employed by Adrema, Ltd., Acton, London, for the Production of Units for the Bradma Range of Equipment

By P. A. SIDDERS, Chief Associate Editor

TOOLING AND TRANSFER EQUIPMENT employed for making printing plates used with the Bradma data processing equipment built by Adrema, Ltd., Telford Way, Acton, London, W.3, were described in the first article* in this series. The development of the organization was briefly discussed, and it was pointed out that the company, which currently has six factories in the Acton area and two at Portsmouth, now forms part of the Farrington Manufacturing Co., U.S.A.

As mentioned in the earlier article, plates for Adrema machines are made in 81 different designs, and some of the more widely used types were described. Plates are made from zinc, aluminium alloy, or steel, and the production of zinc plates, on a bank of five presses with automatic transfer and loading mechanisms, was considered in some detail. Particular reference was made to the type 3R, and it may be noted that plates of this design are also made in an aluminium-based material known as high-tensile light alloy—usually abbreviated to H.T.L.A.

In principle, the procedure for the production of H.T.L.A. plates is the same as for zinc components. For the light-alloy plates, however, the blanks are produced from coil material, and the company has developed a multi-stage press tool, which is equipped with automatic feeding, transfer and stacking arrangements. On account of the shape and dimensions of the plates, the tool is of considerable length, and if a standard press were employed, owing to the size of the platens required, the tonnage capacity would be out of all proportion to that required for the actual pressing operations performed. The company therefore had a press specially built by John H. Ratzer, 4 Pratt Walk, London, S.E.11, and Fig. 1 gives a general view with the tooling in position. This press, in effect, comprises two Ratzer 10-ton ram assemblies on a common base, and both ram units are driven from a single crankshaft, the flywheel of which is within the housing *A*.

The press tool and associated equipment fitted to the press were designed and built by Adrema, Ltd., and incorporate pneumatic units from the Martonair range. The tool is of unit construction, with a vertical magazine *B* for the blanks, and a vertical stacking arrangement *C* for the finished plates. Operating mechanism for the feeding and

* MACHINERY, 99/120—19/7/61.

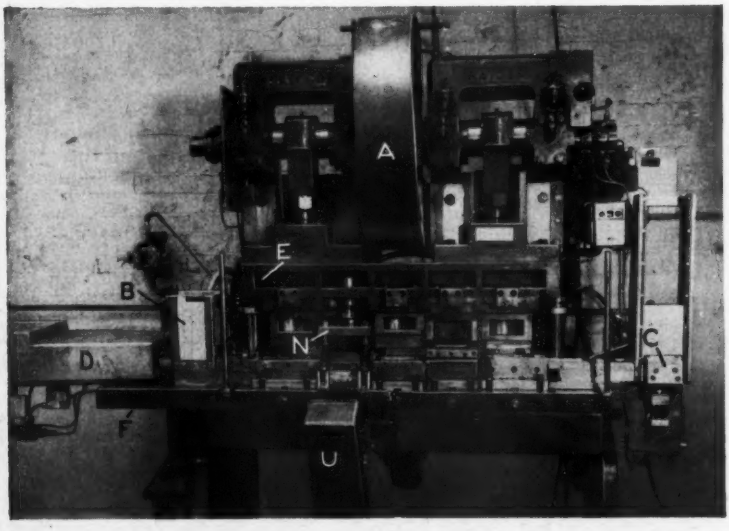


Fig. 1. General view of the Ratzer press and Adrema-built tooling equipment employed for the production of Bradma printing plates from aluminium alloy. An output of 80 plates per min. is maintained

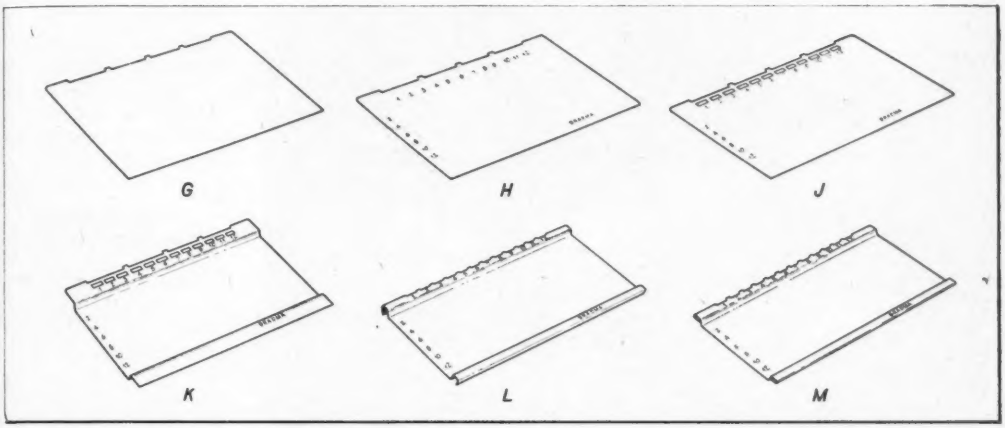


Fig. 2. These perspective views indicate the operation stages required for the production of a finished Bradma type 3R printing plate *M*, from the blank *G*

transfer equipment is housed beneath the cover *D*. Plates are formed in five stages, and there is a separate tool assembly for each stage. These tool assemblies are secured to upper and lower bolsters, as indicated at *E* and *F*, respectively, and guide pillars and bushes are fitted at the rear of the bolsters to maintain alignment. It may be observed that the upper bolster is bolted directly to the two rams, and it incorporates cored pockets, open at the front, which provide access to the clamping screws for certain of the upper tool assemblies.

PRESS TOOL DESIGN

Fig. 2 shows diagrammatically the sequence of operations for the production of the type 3R plate. A blank, as seen at *G*, is produced on a Humphris press with automatic feed, and the remaining stages are completed on the multi-stage tool. These stages are:—*H*, stamp numbers and Bradma trade mark; *J*, pierce slots; *K*, first form to produce a shallow top-hat section; *L*, second form to bend over the long edges; and *M*, final form to complete the folding of the long edges.

The design of each tool unit follows that of the tool for the corresponding stage on the bank of presses employed for zinc plates. For the second forming stage, rollers at either side of the upper tool assembly are employed to bend over the long edges of the workpiece. A travel of 1⅛ in. is required for this stage, which governs the stroke setting of the press. It is desirable, however, that the piercing punches of the tool for the production of the slots (stage *J*) should not be raised clear of the stripper plate, which is of solid type and secured to the lower assembly of the tool. In consequence, the working stroke of this tool should not exceed ½ in., and it is built into a self-contained pillar die-set, as seen at *N* in Fig. 1.

Fig. 3 is a close-up view of one end of the multi-stage tool, and shows the piercing unit. The upper tool assembly is urged upwards by powerful springs on the pillars of the die set, the travel being restricted by washers and nuts on the pillars. A flanged threaded bush *P* is fitted to the upper bolster and carries a screw *R*, with a large disc-shaped head. This screw can be adjusted by means of tommy-bar holes in the head, and secured by a circular lock nut. The screw is set so that, as the upper bolster moves downwards, it engages the top member of the pillar die set, towards the end of the ram travel, and imparts the necessary motion to the upper assembly of the piercing tool. Slugs produced by the blade-type punches *S* pass through the lower tool, on to a chute *T*, and thence into a second chute *U*, Fig. 1 and 3, whereby they are directed into a container beneath the press.

The upper assemblies of the other units on the multi-stage tool are arranged for wedge adjustment. Steel strips, machined to a stepped cross-section, are fitted to the upper bolster, as seen at *V* in Fig. 3, and form guideways for sliding wedges, as at *W*. A sliding wedge is similarly indicated in the sectional view in Fig. 4, and it will be seen that it has a tapped hole which is engaged by a shouldered screw *X* that passes through the bracket *Y*, secured to the upper

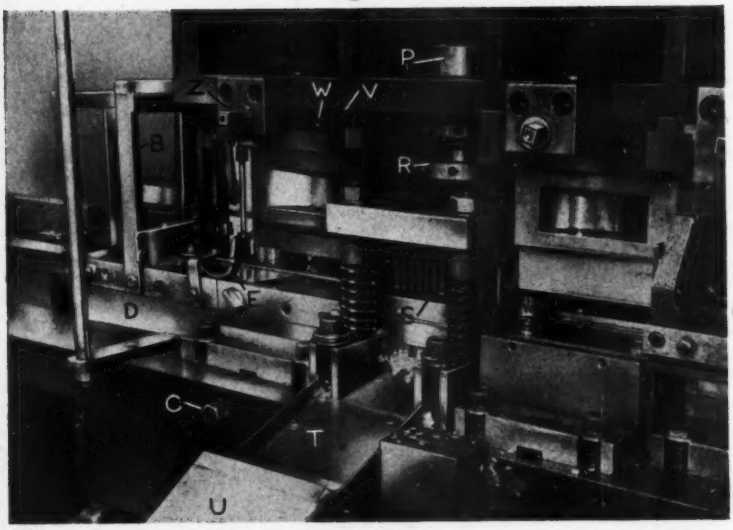


Fig. 3. Close-up view of the multi-stage press tool, showing the units for the stamping, piercing, and first-forming stages. The piercing tool is mounted in a separate die-set, since it has a shorter stroke than the other units

bolster. A sleeve with a square-section body and a large flange is pinned to the end of the screw that projects beyond the bracket, as indicated at *Z* in Fig. 3 and 4, and serves for rotating the screw to adjust the position of the wedge. A stationary mating wedge is located below the sliding wedge. Socket-head screws which secure the upper assembly of the press tool pass through holes in the bolster, and slots in the sliding and stationary wedges. When the screws have been slackened—by means of a key inserted by way of the pockets in the bolster—the vertical setting of the upper tool assembly can be readily adjusted by turning the sleeve *Z*, and index lines are marked on the flange of the sleeve and the front face of the bracket *Y* to facilitate setting. One turn of the screw imparts a movement of 0·002 in. to the upper tool.

Each lower tool assembly is located on the bottom bolster by transverse keys, as at *A* in Fig. 4, and is secured by two screws at the front, also by a hook-member *B* at the rear. This hook-member is pivoted in a block secured to the bottom bolster and the longer limb of the L-shape extends downwards into an aperture in the bolster. The hook-member can be rocked to engage the lower tool assembly by means of a screw *C*, and one of these screws is similarly indicated in Fig. 3. It will be appreciated that the clamping arrangements are such that all the screws for securing the press tool unit are accessible from the front of the press, and removal and replacement of the units are thus facilitated.

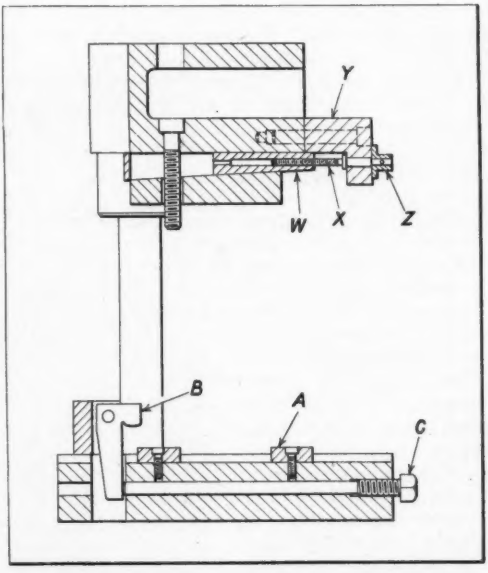


Fig. 4. Sectional view showing the wedge adjustment for the upper assemblies of certain tool units, also the rear clamping arrangement for lower tool assemblies

WORK FEEDING AND TRANSFER MECHANISM

The magazine *B*, Fig. 1, is similarly identified in Fig. 3, and in this latter illustration it is empty. Of frame construction, it is made from steel strip, and the front is free from cross-members to permit access to the stack of blanks. The latter are loaded with the notched edge of each towards the front. In the press-tool assembly, the various

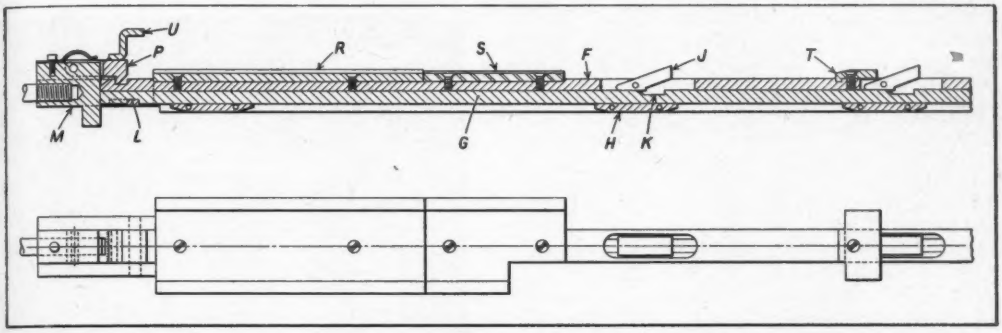


Fig. 5. Part plan and sectional views of the shuttle bar employed for feeding and transferring workpieces from one station to another of the multi-stage tool for the production of printing plates

units are so arranged that the work-support surfaces are on the same level, and the magazine is mounted on a block *D*, of such a height that the lowermost blank in the stack is on the level of the work-support surfaces of the tool units. At each cycle of the press, the lowermost blank is advanced from the magazine by an air-operated feed mechanism, to a position between the magazine and the first tool unit. Here, it is aligned by guide strips at either side of the block *D*, similar strips being fitted to the tool units. In this position, the blank is engaged by a spring-loaded felt pad *E*, which imposes a certain restraint on its movement.

Transfer of the blank from the magazine, and from one tool unit to another, is effected by a shuttle bar that slides in the block *D* and in the lower portion of each tool unit. Plan and sectional views of the end of the shuttle bar adjacent to the magazine are shown in Fig. 5. The bar is of built-up construction, and has an outer member *F*, of inverted-U section, wherein slides an inner member *G*. Bearing plates, as at *H*, are pinned at intervals along the groove in the outer member, and serve to support and retain the inner member. Slots are cut in the upper web of the outer member, and a dog, as at *J*, is pivoted in each slot. The pivot point of each dog is so arranged that the dog normally tends to swing in a clockwise direction (as viewed in Fig. 5). Notches, as at *K*, are cut in the upper face of the inner member, and when this member is moved to the right, relative to the outer member, the angle-faces of the notches raise the dogs to the position shown. When the inner member is moved in the other direction, the dogs swing until they are completely housed in the outer member.

The inner member is connected by a transverse key *L* to a block *M*, which is coupled to the piston rod of the actuating air cylinder. Slots are cut in the sides of the outer member to allow the key, and with it the inner member, to move through ⅜ in. A hook *P* is pivoted on the block *M*, and is urged by a leaf spring into engagement with a transverse slot in the outer member of the shuttle bar. The arrangement is such that with the hook engaged, the block *M* and the inner and outer members of the shuttle bar move together. When the hook is disengaged, however, the inner member can move to the left through ⅜ in. until the key *L* contacts the ends of the slots in the sides of the outer member, or through the same distance to the right until the block *M* abuts the end of the outer member.

Two plates *R* and *S*, of shallow channel section, are secured to the outer member, and the upper surfaces at either side of the plate *S* are 0·012 in. below the corresponding surfaces of the plate *R*. When the outer member is in the extreme left-hand position, as viewed from the front of the press, the lowermost blank in the magazine rests on the plate *S*. As the shuttle bar is moved to the right, the blank is engaged by the edge of the plate *R*, and is carried out of the magazine, the stack of blanks being supported by the upper surfaces of the plate. Attention is also drawn to the block *T*, screwed to the outer member of the shuttle bar. This block is located beneath the component in the first tool unit, when the shuttle bar has completed its travel to the right, and serves as an anvil for the stamping of the shorter column of numerals (seen at the left of the component *H* in Fig. 2).

SEQUENCE CONTROL

Fig. 6 is a view of the special press from the left-hand end, and the magazine is again indicated at *B*. The air cylinder for the feed mechanism is seen at

N, and it is controlled by means of two pilot air valves *U*, which are mounted on a plate secured to the press frame. These valves are fitted with roller-lever actuators, and are operated by the cams *V*, on the end of the press crankshaft. The pilot valves are connected to main valves below the air cylinder.

At the start of a feeding and transfer cycle, the piston of the air cylinder, and the two members of the shuttle bar are at the extreme left-hand limits of their travel. The two members are locked together by the hook *P*, Fig. 5, and the dogs are raised. When air is directed to the left-hand end of the air cylinder, the piston is moved to the right, and the shuttle bar is moved in the same direction to feed a blank from the magazine, and advance the workpieces from one tool station to the next.

At the end of the piston travel, the shuttle bar is held stationary while the press rams descend, and the tools perform the various stamping, piercing and forming operations. A block is bolted to the left-hand end of the upper bolster, and is seen at *A'* in the close-up view, Fig. 7. Two rods

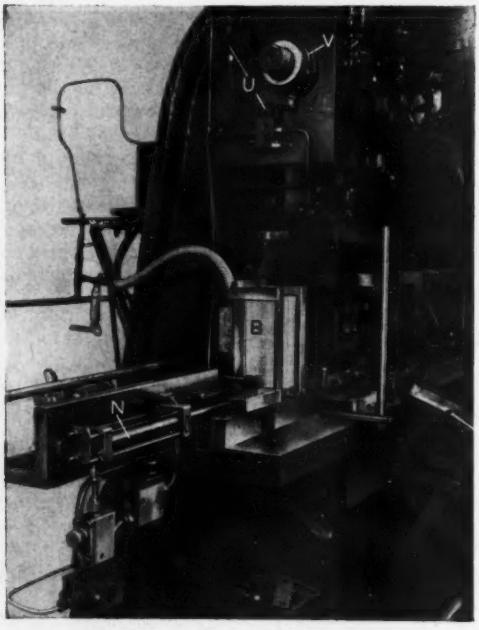


Fig. 6. A view from the left-hand end of the special press, showing the magazine of the Adrema multi-stage tool, also the air cylinder for operating the shuttle bar that feeds blanks and transfers workpieces from one station to another

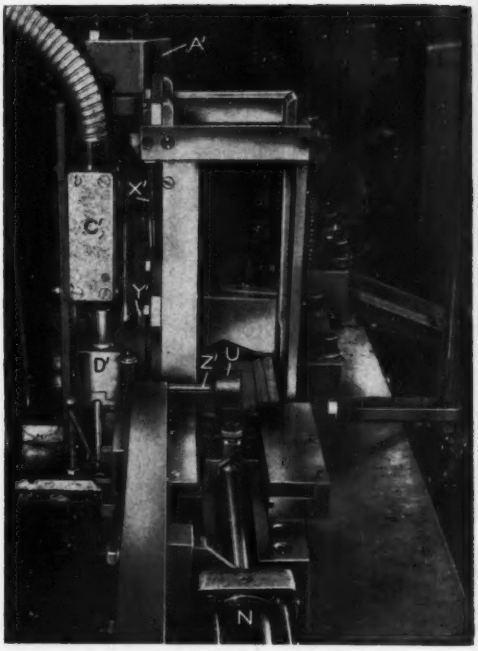


Fig. 7. Close-up view of the feed mechanism for the multi-stage tool. A safety device stops the press if the feed motion has not been completed

are free to slide in this block and are spring-loaded downwards. One rod is indicated at *X'* in Fig. 7, also in Fig. 8, which is a close-up view from the front of the press. As the press rams approach the end of their downward travel, the rod depresses a lever *Y'*, Fig. 7 and 8, which is pivoted at one side of the magazine support block. The end of the lever carries a transverse pin *Z'*, Fig. 7, which lies beneath the claw *U*, Fig. 5 and 7, when the shuttle bar is at the end of its movement to the right. This claw is brazed to the retaining hook *P*, Fig. 5, and as the lever is pivoted, the pin *Z'*, Fig. 7, lifts the claw, and with it the hook, so that the outer member of the shuttle bar is freed from the inner member. During the last part of the downward movement of the press rams, the rod *X'* remains stationary, and the spring associated with it is compressed.

When the press rams move upwards, the rod *X'* holds the lever down, owing to the action of the spring, and air is directed to the right-hand end of the cylinder *N*, to return the piston to its original position. At the start of the return travel,

the outer member of the shuttle bar remains stationary, and the inner member moves with the piston rod. In consequence, the dogs swing into the slots in the outer member. As the return movement continues, the key *L*, Fig. 5, contacts the ends of the slots in the outer member, and the two members then move together. During this motion, the claw *U* moves clear of the transverse pin before the lever is released, and the hook *P* is swung down by the associated leaf spring. When the piston reaches the limit of its travel, the outer member continues to move, due to its momentum, and is re-engaged with the inner member by means of the hook *P*, Fig. 5, in readiness for the next cycle.

The second sliding, spring-loaded, rod in the block *A'*, Fig. 7, forms part of a safety arrangement whereby the press is stopped if a feeding cycle has not taken place. Indicated at *B'* in Fig. 8, this rod is fitted with an adjustable trip-collar to actuate a limit switch mounted at the side of the magazine, as seen at *C'* in Fig. 7. The lower end of the rod enters a block *D'*, wherein slides a plate. This plate is coupled to a lever which is mounted on a vertical pivot, below and to the rear of the feed mechanism. In the plate there is a hole that provides clearance for the rod, and with the shuttle bar in its left-hand setting, the plate is held by a tension spring in such a position that the hole is aligned with the rod. When the shuttle-bar is advanced to feed and transfer the work, the block *M*, Fig. 5, engages the lever and swings it about its pivot, so that the plate is displaced. Then, as the press rams descend, the movement of the rod *B'* is restricted, since the hole in the plate is no longer in alignment with it. In consequence, the trip collar on the rod is held clear of the roller on the actuating lever of the limit switch. Should a feeding cycle not be completed, however, the rod passes through the plate, and the limit switch is tripped to cut off the power supply to the main drive motor and engage a built-in electro-magnetic brake.

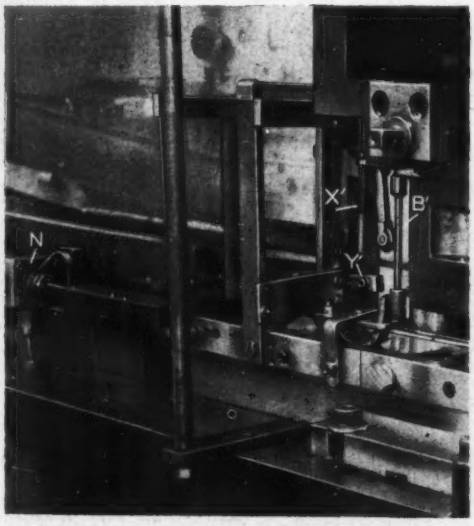


Fig. 8. Spring-loaded trip rods *B'* and *X'* are employed, respectively, to stop the press in the event of misfeeding, and to disengage the outer and inner members of the shuttle bar for the transfer mechanism

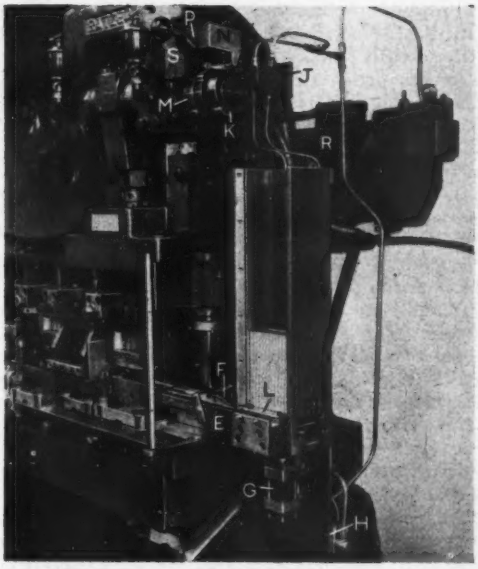


Fig. 9. When the printing plates have been completed, they are advanced to a position below this vertical stacking unit, into which they are thrust by an air cylinder controlled from the press crankshaft

AUTOMATIC STACKING UNIT

As the workpieces are moved from one stage to the next of the press tool, the notched edge of each is held in contact with the guide strips at the front of the tools by a spring-loaded strip at the rear of each unit. From the last tool assembly (for the final forming stage), the completed plates are advanced along a guide that leads to a

vertically-disposed, automatic stacking unit. This unit is seen in Fig. 9, and the guide is indicated at *E*. As each plate is advanced by the shuttle bar, it passes under a spring-loaded felt pad *F*, and finally comes to rest below the magazine chute. In this position, the plate is above an air cylinder *G*, which is controlled by pilot-operated valves, as at *H*. These valves are connected to pilot valves, as at *J*, mounted on a bracket secured to the press frame, and each pilot valve is fitted with a lever-type actuator, and operated by a cam, as at *K*, on the end of the press crankshaft. During each cycle of the press, one valve is tripped so that air is directed to the lower end of the cylinder *G* to lift the plate, that has just been delivered, into contact with the stack in the magazine chute, and to raise the stack through a distance equal to one plate thickness. The stack is held in its new setting by spring-loaded strips at the front and rear of the chute, as seen at *L*, when the second valve is tripped later in the cycle, and the piston of the air cylinder is returned.

It may be observed that there is a third cam *M* on the crankshaft, and this cam provides for single-cycle working of the press. A lever-actuated limit switch *N* is mounted on an arm *P*, which is pivoted on the press frame, and the switch is connected in the control system for the main drive motor *R*. (The electro-magnetic brake for this motor can be clearly seen in the illustration.) When the arm is moved to the setting shown, as controlled by the gate plate *S*, the cam *M* trips the switch *N* after the crankshaft has completed one revolution, and the driving motor is stopped. By moving the arm upwards to the other limit of the gate, the switch lever is held clear of the cam, and the driving motor runs until it is stopped by the main control push-button.

With the equipment that has been described, plates are produced at a rate of 80 per min. Some other interesting tooling for the production of pressings at the Adrema works will be described in a further article to be published shortly in MACHINERY.

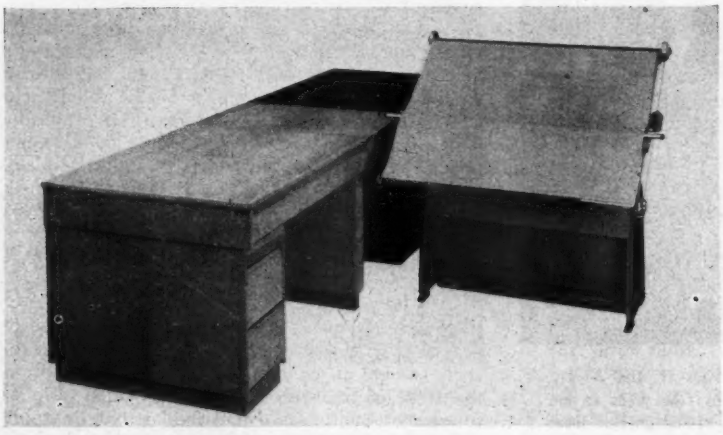
Hall Harding Drawing Office Furniture

A new range of drawing office equipment, comprising a free-standing drawing table, unit-construction reference tables and spacer units, and a combined drawing and reference table, has been introduced by Hall Harding, Ltd., Stourton House, Dacre Street, London, S.W.1.

Known as the Cavendish, the free-standing table can be set at angles up to 85 deg. from the horizontal position and has a vertical adjustment of 14 in. When it is necessary to raise or to lower the table, a foot bar is depressed to release the vertical lock. A constant-tension spring arrangement ensures a smooth motion, and avoids the need for heavy balance weights in the mechanism.

The reference tables are 30 in. high and are available with three interchangeable pedestals with various drawer, cupboard, and pull-out tray arrangements. Spacer units, in matching sapele mahogany or oak, can be bolted between two reference tables, for instance, and with this arrangement a long uninterrupted working surface is provided.

A height adjustment of 12¾ in. is obtainable on the Chalfont combined drawing and reference table unit, and the height of the reference table is 30 in., so that it can be used in conjunction with the separate tables.



The new Hall-Harding Cavendish drawing and reference tables

Some Factors Affecting Close-tolerance Gauging

By F. PARDEE*

THE SCIENCE OF QUALITY CONTROL has shown that in order to produce work to a stated tolerance the means of measurement should be capable of discriminating to at least one-seventh of that tolerance. For convenience in stipulating tolerances in gauge making, however, the figure of one-tenth is usually adopted. Thus, if a gauge is to measure a size difference of 0·0001 in., its own tolerance must be 0·00001 in. Proceeding a stage further, the gauge, in turn, must be checked with a master standard accurate within 0·000001 in.

At present, however, a master standard cannot be produced to an accuracy of one millionth of an inch, and some compromise must be made. It is the general practice to broaden the tolerance of the master gauge to a figure that can be attained, and to make a corresponding reduction in the tolerance of the working gauge that is to be checked In this way, an accuracy will still be achieved which is one-tenth that of the workpiece tolerance, or close to this figure. It is now widely accepted that the reliability of an end-product is directly dependent upon the reliability of the standards of measurement under which it is produced. Tools and machines have been developed to the point where many are capable of very accurate sizing, and gauging equipment that can show a difference of a millionth of an inch has been available for some time. Success in production to close tolerances depends to a great extent upon the skilful use of this equipment, and in this connection there is a number of factors which can exert influences, and must be taken into account.

For example, a simple experiment will show how dirt can affect accurate measurement. Thoroughly clean a gauge block, using a lint-free chamois, and a filtered solvent such as alcohol, and polish the anvil of a millionth comparator in a similar manner. Place the gauge block in the comparator, and set the instrument to zero reading. Now remove the block and, in the customary manner, wipe it "clean" with the palm of the hand. Also, in a similar way, wipe the anvil of the comparator. When the gauge block is returned to the comparator it will be found that the thickness has increased by as much as 0·000005 in.

There are other reasons for reducing manual handling of both gauge and workpiece to a minimum, important among which is the effect on gauging temperature. While it is well known that metals increase in size with a rise of temperature, it is not so generally realized how fast a component or a gauge can absorb heat from handling, and how long it takes to cool down again to room temperature. The frame of an 8-in. micrometer, for example, may expand by as much as 0·0015 in. when gripped in the normal way for 5 min., but

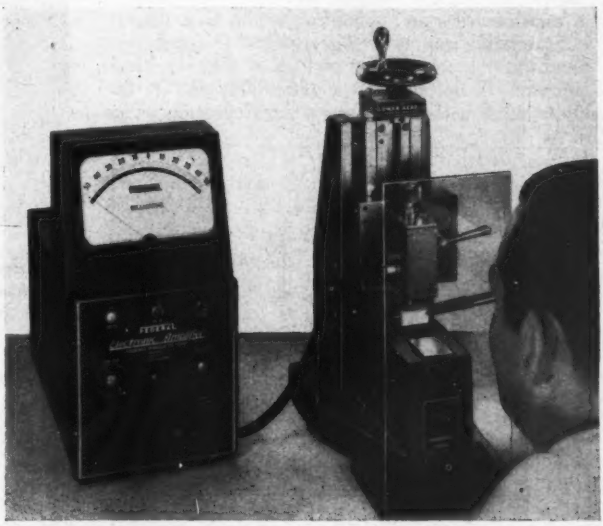


Fig. 1. Checking a gauge block with the aid of an electronic comparator. To obviate errors from body heat, the block is handled with insulated forceps, and a plastics screen is provided in front of the instrument

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it must be put down for about half-an-hour before it returns to normal size.

Sunlight entering through windows, and the heat from radiators can often have a serious effect on measuring accuracy, as can cold draughts. For these reasons, air conditioning with close temperature control is essential for the most accurate measurements. On the other hand, conditions adequate in many circumstances can be obtained by allowing the workpiece and gauge to remain in the same environment sufficiently long to ensure that their temperatures have become equalized. Another method of preventing large variations in working temperature is to provide a heat insulating enclosure. The effects of body heat can be mimimised by the provision of a plastics shield in front of measuring instruments as indicated in Fig. 1, where, it will be noted, the gauge being checked on the comparator is handled with insulated forceps. Deflection of gauge mountings may be another source of error, the amount of which can be demonstrated by the use of a sensitive indicator, as seen at *A* in Fig. 2, arranged beneath the arm carrying the gauge *B*, for measuring the workpiece *C*.

Too heavy a gauging pressure may also result in distortion of the workpiece and cause appreciable errors in measurement. The application of a micrometer in the normal manner can result in a force of 2 lb., and according to the U.S. Bureau of Standards, a force of 6 oz. applied to a spherical anvil in contact with the surface of a gauge block can cause a deformation of 0·000003 in. On the other hand, with indicator gauges deflection errors are much smaller since the force exerted is normally about 1 oz. Electronic transducer gauging heads are available that exert forces of less than three gm., or 0·1 oz., and the pressure resulting from air gauging systems is also very light.

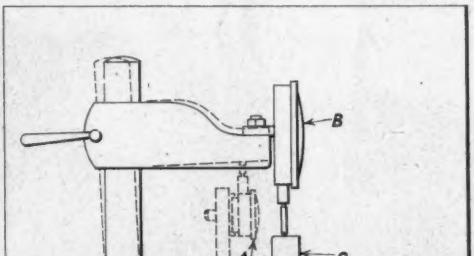


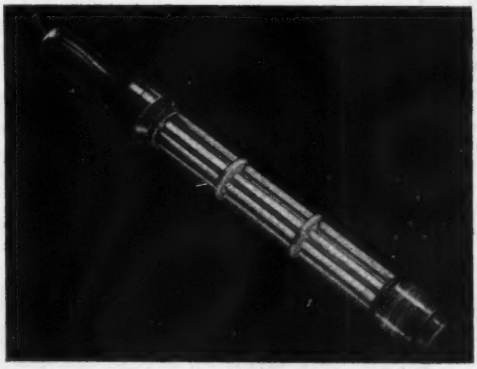
Fig. 2. Application of a sensitive indicator at *A*, to detect the deflection of the mounting arm of a comparator

Another important factor is repeat accuracy, which determines how closely successive readings of the same dimension agree. The repeat accuracy of a linear measuring instrument should be a relatively small percentage of the value of the smallest graduation, and it should always be within 10 per cent of the workpiece tolerance.

In general, when working in the 0·0001-in. tolerance field, it is essential to have available accurate gauges of adequate sensitivity and magnification.

Hargreave Type K Flameproof Hand Inspection Lamp

In the accompanying figure is shown the type K hand inspection lamp introduced by J. M. Hargreave & Co., Ltd., Central Avenue, West Molesey, Surrey, for which, it is stated, a Buxton flameproof certificate has been given, for use in atmospheres of Groups II and IIIa gases.



Hargreave Type K flameproof hand inspection lamp which has an overall length of 18¾ in. and can be supplied for operation on a.c. or d.c. supplies

Light is provided by an 8-in. fluorescent tube, and the lamp has an overall length of 18¾ in., a diameter of 2⅛ in., and weighs less than 3 lb. The accompanying ballast unit can also be flameproofed, if necessary. Lamps can be supplied for operation on 230/250 volts a.c., 24/28 volts d.c., or on various other voltages to suit customers' individual requirements.

The Production of Hydraulic Pit-props

Methods Employed by Dowty Mining Equipment, Ltd., Ashchurch, Glos.

By S. C. POULSEN, Associate Editor

IN TWO EARLIER ARTICLES IN MACHINERY, 99/82—12/7/61 and 99/180—26/7/61, were described some of the methods employed by Dowty Mining Equipment, Ltd., Ashchurch, Glos., for producing components for their hydraulic pit-props. These two articles were concerned with examples of the work performed in the receiving inspection, preliminary fabrication, and valve assembly sections of the factory. Here, the main production lines, devoted to final fabrication, assembly, and testing, are considered.

The layout of this portion of the factory is shown diagrammatically in Fig. 1, in which the arrangement of the extensive overhead conveyor system is also indicated. All major welding operations are performed on automatic machines, which are in course of conversion, by the company, from the open arc and submerged arc processes, to the CO_2 shrouded arc process. In the firm's experience, the latter process is less critical as regards cleanliness of the work, gives sounder welds, permits higher rates of welding, and produces welds that are notably free from scale, so that subsequent cleaning is facilitated. As indicated in the first of the two preceding articles, the products of the factory comprise props of the earlier "standard", and later Mark IV Duke designs. The machines for welding components for these two designs are arranged on opposite sides of the overhead conveyor, on which the parts are brought to the lines in sets, from the storage area.

A typical set-up, for welding the bottom end-caps to the Duke outer tubes by the CO_2 process, on a 30-kVA. [Associated Electrical Industries (Manchester), Ltd.] machine, is shown in the close-up view in Fig. 2.

This machine, which is situated at *A*, Fig. 1, is of a 2-station design, and the traversing head is fitted with Philips CO_2 nozzles. Loading is carried out at one station, while the other is in use. The end-cap is inserted in the lower end of the tube before the components are loaded into the machine, where the cap is located in a contoured recess in the driving fixture *B*, and the tube rests against two pairs of rollers, *C*. When the automatic cycle is started, the bung *D* is advanced into engagement with the upper end of the tube by a pneumatic ram, to clamp the work axially against the fixture *B*, and two additional rollers, also pneumatically operated, are advanced against the sides of the tube, towards the lower end. These additional rollers, one of which may be seen at *E*, serve to seat the work firmly against the lower fixed rollers *C*.

Next, the head is traversed into position, and the work, which is driven at one revolution in 32 sec., by the fixture *B*, is welded. A current of 325 amp. is employed, and the $\frac{3}{64}$-in. diameter wire is fed at 250 in. per min., to produce a fillet-weld $\frac{5}{16}$ in. to $\frac{3}{8}$ in. wide. When the work has completed one revolution, the current is cut off, wire feed ceases, the bung and rollers are with-

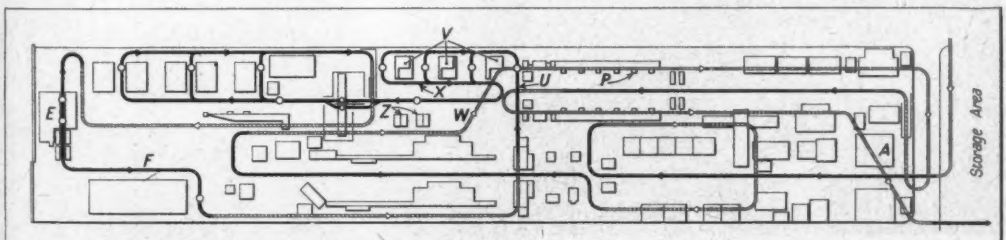


Fig. 1. In this diagrammatic layout of the main production lines may be seen details of the extensive overhead conveyor system, on which the components are carried, in sets, from the storage area

drawn from the work, and the head traverses to the other station.

The machine then stops, with the head positioned in readiness for the next cycle, and the welded assembly is unloaded.

PRESSURE TESTING

When the work has cooled sufficiently, the welds are checked for porosity, on rigs of the design shown in Fig. 3. The assembly to be checked is located centrally beneath the hydraulic ram *F*, on a support pad, by the air-operated clamps *G*. Both the hydraulic ram, and these clamps, are controlled by means of manually-operated valves. Once the assembly is clamped, the hydraulic ram is actuated, and a sealing plug is thereby lowered into engagement with the bore of the tube. A small quantity of hydraulic fluid is delivered into the tube through a bore in the ram and plug, by means of another valve, and is then pressurized to 3,000 lb. per sq. in. by continued downward travel of the ram, the plug meanwhile serving as a piston. Any porosity of the weld is revealed by leakage of fluid. On completion of the test, the fluid is tipped out of the assembly into a sump at the base of the rig, and the work is placed on a "cooling" section of the conveyor, on which it is transferred to the guard-tube assembly station.

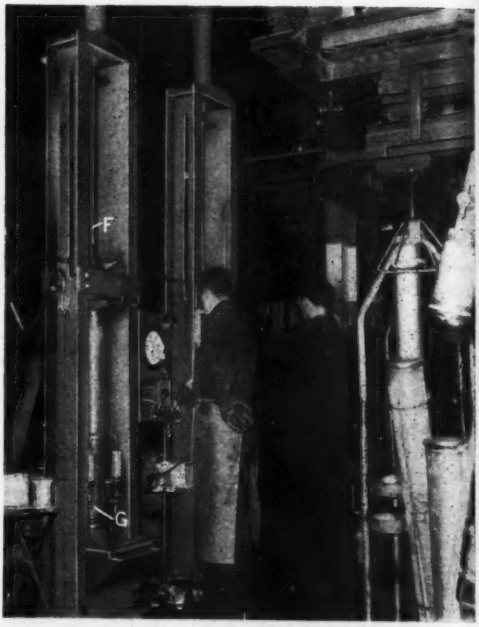


Fig. 3. The welds are subsequently tested for porosity on hydraulic rigs of the design here shown, at a pressure of 3,000 lb. per sq. in. Fluid used for testing is admitted through the sealing-plug and ram

Fig. 2. At this set-up on a 2-station Associated Electrical Industries, Ltd., 30-kVA automatic machine, the end-caps are welded to the outer tubes by the CO_2 shrouded arc process. Each weld is completed in a cycle time of 32 sec.

GUARD-TUBE ASSEMBLY

Here, the outer tubes are inserted in the guard-tubes, and the flanged collars are tack-welded to the upper ends of the latter at four points. Welding of the guard-tubes to the bottom end-caps is carried out on the 40-kVA. automatic machines [A.E.I. (Manchester), Ltd.] shown in Fig. 4, by the submerged arc process, pending conversion of the machine for

CO_2 welding. Although two welding heads are provided, only one is used for the application here considered. The various clamping and locating elements are pneumatically operated, including a section of the rails *G*, which serves as a lifting platform. At the end of the cycle, the machine stops with the rollers *H* and *J* swung aside, the ram *K* withdrawn, and the rails *G* lowered, in readiness for unloading the work.

The assembly to be welded is placed on the rails *G*, and when the cycle is started, the work is raised into line with the ram *K*, and a recessed pad on the driving spindle of the head *L*. Next, the ram *K* is energized, and a tapered and shouldered bung is advanced into the end of the outer tube, which is thus located centrally. At the same time, the assembly is thrust towards the left, so that the end-cap is located and clamped in the recessed pad. The rails *G* are then lowered, the work is rotated, and the rollers *H* and *J* are swung into position, as shown. Those at *H* serve as an end-stop, against which the guard-tube is slid axially along the outer tube, by the action of those at *J*. The amount that the outer tube projects beyond the guard-tube is thus accurately maintained, to ensure the production of a fillet weld of predetermined width at this point.

Once the guard-tube has been located, the welding phase of the cycle is initiated, and the rollers *H* and *J* are immediately swung clear. The rate at which the work is rotated is one revolution in 35 sec. Welding wire of ⅛-in. diameter is fed at 60 in. per min., and a current of 400 to 450 amp. is employed. On completion of the weld, the rails *G* are raised, the ram *K* is retracted, and the rails *G* return the welded work to the loading position, whence it is replaced on the conveyor, which carries it to the paraffin spray wash plant shown in Fig. 5. This equipment was designed and built by the company, and incorporates a Teleflex overhead conveyor with 24 hangers. The speed of the conveyor is steplessly vari-

Fig. 5. This paraffin spray wash plant, designed and built by the company, is employed for cleaning the major assemblies after welding. The speed of the Teleflex overhead conveyor is steplessly variable

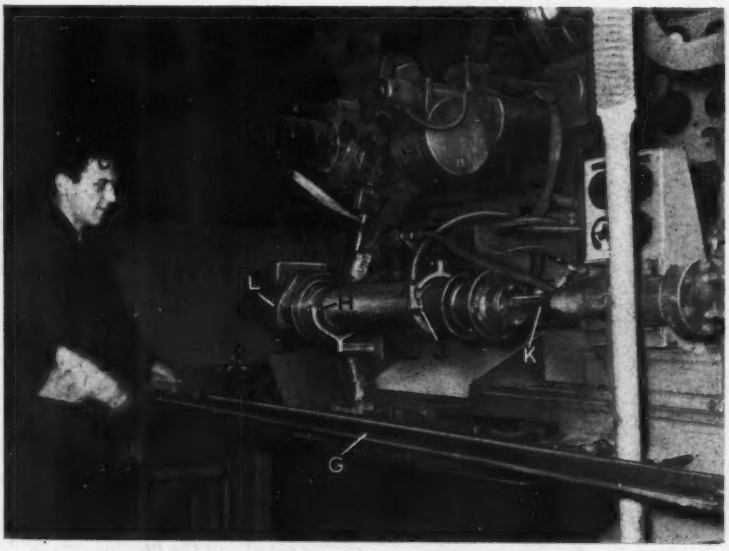


Fig. 4. At this set-up for welding the guard-tubes to the outer tubes, on another A.E.I., Ltd., machine, the guard-tube is located automatically by the air-operated rollers *H* and *J*, before welding is begun

able from 19 to 57 in. per min., and it is usually run at 20 in. per min. In the enclosed working section, there is a total of 340 spray nozzles, and the paraffin is re-circulated continuously through a Philips clarifying filter.

WELDING THE INNER TUBES

Piston-heads are CO_2 welded to the inner tubes on the 25-kVA. machine [A.E.I. (Manchester), Ltd.] shown in Fig. 6, only one of the two heads being used for this operation. To facilitate location of the piston-head in the required relationship to the crank housing, the trolley fixture seen at *M*, and a brass cup, are employed. This trolley is supported on rails, in which there is an air-operated lifting section, as in the preceding example. The piston-head is inserted in the end of the tube, and over it is placed the brass cup, which has an internal peg that engages the relief-valve bore. When these items are loaded on to the trolley, a peg on the latter engages a hole in the side of the cup, and the crank housing is located by the U-plate *N*.

The loaded trolley is moved on to the lifting section of the rails, whereby the work is raised into line with the pneumatic ram seen at the right. When the ram is energized, a shouldered bung is advanced into engagement with the open end of the tube, and the latter is thrust to the left, so that a recess in the outer end of the cup is engaged with another bung, on the work-head. The lifting section of the rails is then lowered, carrying the trolley with it, and the welding cycle is started. During the cycle, the trolley is reloaded. Welding is carried out with the work rotating at 3·75 r.p.m., and the rate of wire feed is 200 in. per min. It may be noted that the corresponding rate of welding, with the open arc process originally employed, was 2 r.p.m. At the end of the welding cycle, the work is unloaded with the aid of the lifting rails, and after the weld has been cleaned, the sub-assembly is placed on the cooling conveyor, on which it is carried to the paraffin wash plant.

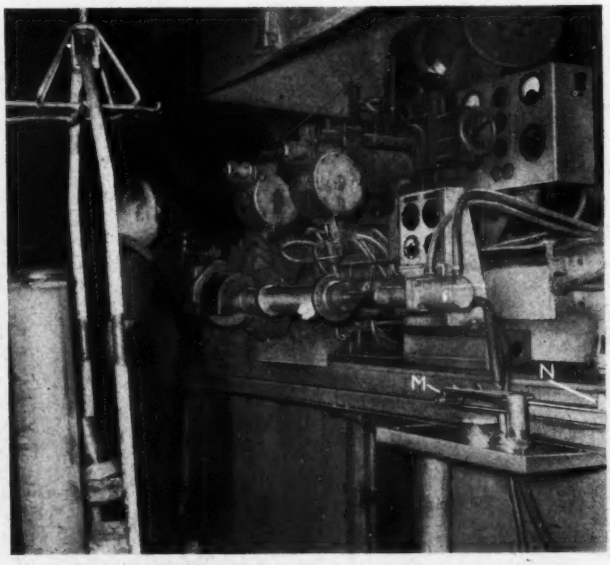


Fig. 6. At this set-up for CO_2 welding the piston-heads to the inner tubes, location is facilitated by the trolley fixture *M*. Each weld is completed in a cycle time of 16 sec.

ASSEMBLY

When the work has been cleaned, it is replaced on the conveyor, on which it is delivered to a series of bench stations *P*, Fig. 1. At the first of these stations, it is visually inspected, and the external diameter is checked by means of a dial-type snap gauge. On the basis of this check, the sub-assemblies are segregated into three categories, and colour-coded accordingly, for selective assembly with the split bearing rings. The remaining stations are equipped with simple fixtures, in each of which the work is held vertically by a toggle clamp, to facilitate assembly of the various details.

At the end of the line of bench stations, there is a filling rig, of the design shown in Fig. 7, on which each outer tube sub-assembly, in turn, is set-up. The tube is supported on a platform, and engaged by a pair of air-operated vee clamps, *Q*. A nozzle *R*, mounted pivotally between the uprights of the rig, is swung into a horizontal position, over the work bore, into which a quantity of hydraulic fluid is delivered. The inner tube sub-assembly is inserted in the bore, and a hydraulic ram S is applied, to close the prop. This ram is fitted with a standard prop extension *T*, and a peg that depresses the release-valve push-rod, so that during closure, the inner tube is filled with hydraulic fluid. While the prop is still in the rig, the split bearing ring is assembled in the taper in the upper end of the outer tube, and the bearing cap is slid over it.

Following this stage, the work is transferred to a 3-station indexing

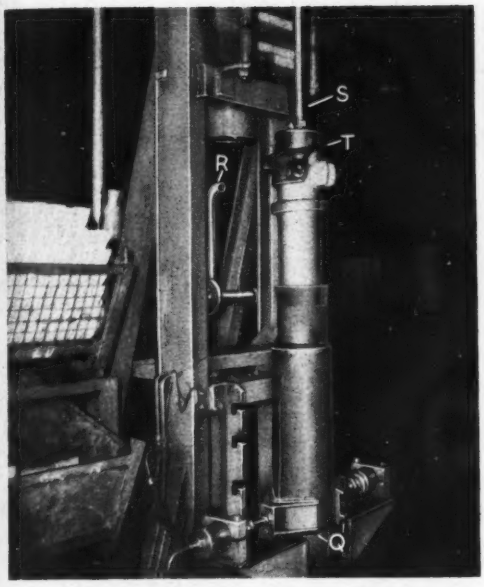


Fig. 7. In this hydraulic rig, the outer tube sub-assemblies are filled with hydraulic fluid

fixture, tended by three operators. Here, the prop is topped up with hydraulic fluid, and the breather valve and top extension are assembled. From this station, the props are loaded on to another overhead conveyor, indicated at *U* in Fig. 1, which is of an indexing type, and serves the test and painting sections.

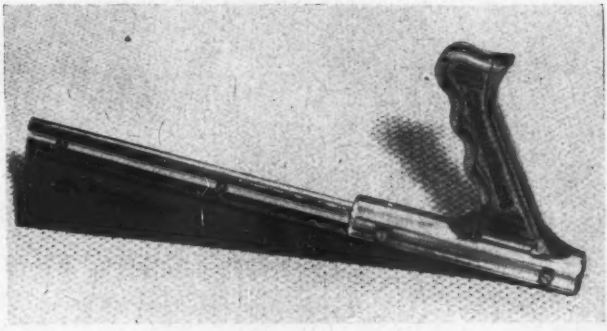
In the test section, there are five rigs which are grouped, as indicated at *V* in Fig. 1, on either side of the conveyor dead-lines *X*. The main conveyor is so arranged that the props must pass through the test section by way of the dead-lines, in batches of four or five. Testing is carried out during the indexing dwells, and after a batch of props has been tested it is transferred from the dead-line to the live section *W* of the main conveyor. Each rig incorporates a hydraulic ram, and a prop is first tested under the full load of 20 tons then at successively lower loads to ascertain that the valve seats correctly after release. This test is followed by a low-pressure test in the rigs at Z, Fig. 1, to ascertain that the valves seat correctly under comparatively light loads.

From the test stations, each prop is carried by conveyor to a station where the bearing cap is tack-welded to the upper end of the outer tube, and from this position it is conveyed to another test line. Among the tests here performed is a closure check to ensure that the release valve can be closed readily by hand. Following these tests, the completed props are passed to the painting section *E*, Fig. 1, in which they are sprayed with white paint. The conveyor that serves the painting section is used to deliver props to a loading bay *F*, where each is subjected to a visual check before it is unloaded directly into a lorry.

The factory is served by a large, well-equipped test-house and development department, where sample batches of props, selected at random from the production lines, are tested periodically. Tests are performed that are similar to those in the main shops but of greater severity. Rigs are available for investigating valve and gland performance also for checking the maximum loading of the malleable iron top extensions, which are designed to fail at a lower load than the props.

Steadfast Sheet Saw

In the accompanying figure is shown the Steadfast sheet saw, which has been added recently to the range of tools made by J. Stead & Co., Ltd., Manor Works, Cricket Inn Road, Sheffield, 2, and is intended for cutting a wide variety of materials, including steel and other metals, plastics, asbestos products, and wood. The tool incorporates an aluminium alloy spine member, with a shatter-proof plastics handle, which provides rigid support for a detachable, 12-in., triangular-shaped blade, made from Cobaltcrom abrasion-resistant steel. Blades with 14 and 24 cutting teeth per in. are supplied, and can be obtained separately.



Steadfast sheet saw

Selwood Rotary Petrol Engine

Demonstrations were given recently at the works of W. R. Selwood, Ltd., Chandlers Ford, Southampton, of the Selwood 2-stroke rotary petrol engine seen in Fig. 1, which has been developed by the company in collaboration with Mr. C. Hughes. Various advantages are claimed for this engine, and the design is the subject of a patent application. Fig. 2 is a view of the engine partially dismantled, with the cylinder heads withdrawn, and some of the pistons may be seen in the foreground. A schematic sectional view is shown in Fig. 3.

So far, only the prototype engine of 700 c.c. rating has been built, and it is pointed out by the inventors that the design may well be modified in the light of experience gained by further trials. In its existing form, the engine has a 10¾-in. diameter barrel-shaped block *A*, in which six arcuate cylinder bores *E* are symmetrically spaced.

Operating in the cylinders are six double-ended curved piston assemblies, the component parts of one such assembly being indicated at *F*. At the centres, the piston assemblies are attached to a spider *G* which rotates on an axis inclined to that of the engine. The orbital path of the spider crosses the path of the rotating engine block, with the result that there is relative oscillation of the pistons in the bores, the resulting variation in the volumes of the combustion spaces being approximately in the ratio of 3 to 1. A mixture of petrol, oil, and air suitable for a 2-stroke engine, is forced by a Rootes-type blower through the hollow fixed shaft *B*, and passes through ports *H* into the cylinders. The exhaust gases are discharged through holes in the body, as at *C*.

Coil ignition is employed, and standard sparking plugs *D*, six at each end of the block, are provided with pads that clear fixed electrodes by about 0·010 in. In effect, therefore, the engine serves as its own distributor, the sparks jumping the gaps as the opposite cylinders are engine rotates. Two arranged to fire simultaneously, to give a

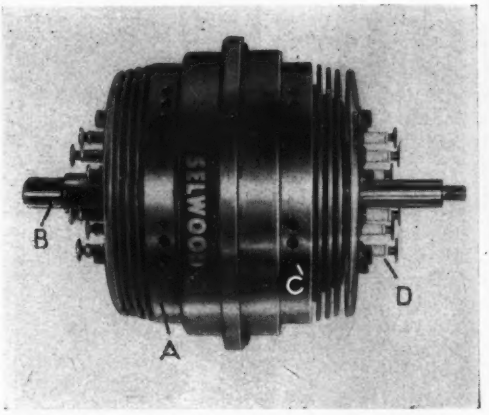


Fig. 1. Selwood rotary petrol engine

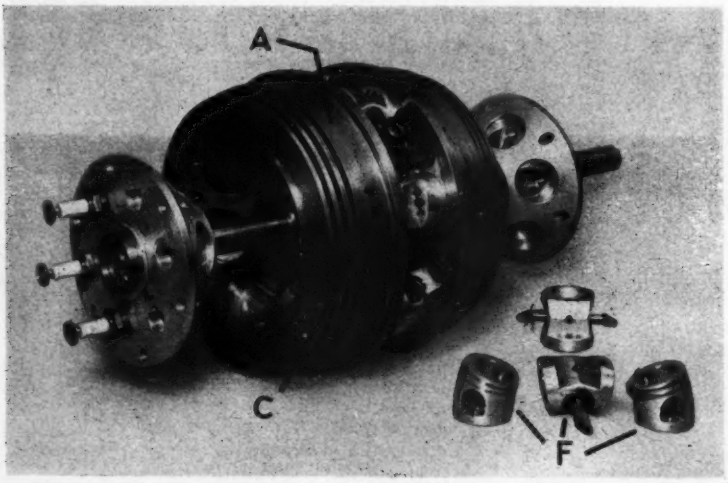


Fig. 2. View of the engine partially dismantled

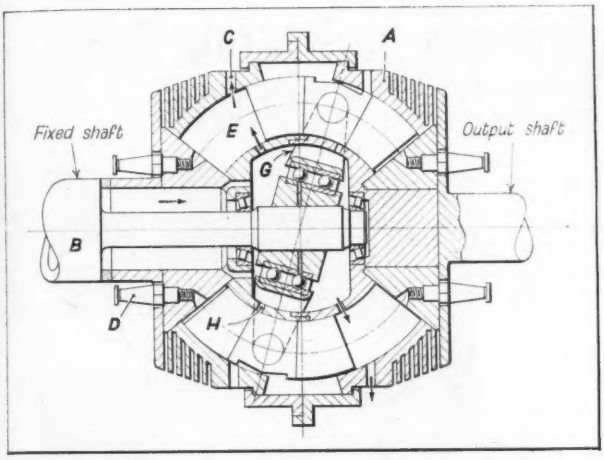


Fig. 3. Sectional view of the Selwood engine

balanced torque. Smoothness of running is thus equivalent to that of a 12-cylinder 4-stroke engine, and with this firing arrangement there is no end thrust on the main bearings. A steplessly-variable masking arrangement is provided for the ports, whereby fuel consumption, it is stated, is reduced. Adjustment can be carried out while the engine is running, and it can be made automatically, if required, according to engine speed. The rotating block stores energy produced during the working cycle, and a separate flywheel is not required. The rotary movement assists in heat dissipation, which is further augmented by cooling fins.

It is stated that the weight of a 1,000 c.c. production unit will be less than 60 lb., and that, for special duties, this figure could be reduced to 45 lb. A similar engine, the makers claim, could be built, with a suitable compression ratio, to run on a compression-ignition cycle.

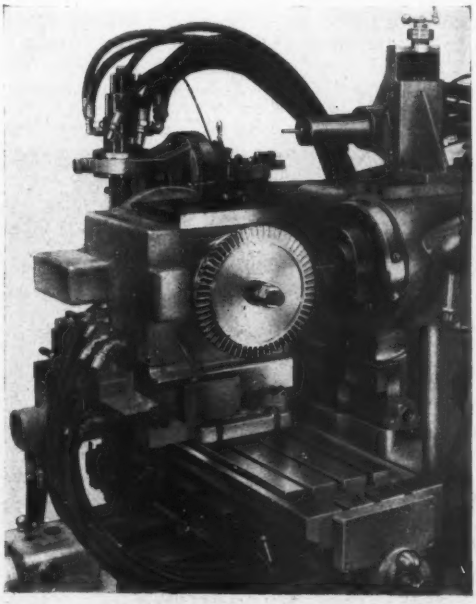
MALLORY 53 NICKEL-SILICON-COPPER ALLOY. Johnson Matthey & Co. Ltd., 73-83 Hatton Garden, London, E.C.1, have recently introduced Mallory 53, a nickel-silicon-copper alloy to meet the need for a spring material with mechanical properties at least equal to those of conventional phosphor bronzes and brasses, but with appreciably higher electrical conductivity.

All spring-forming operations can be performed on Mallory 53 after heat-treatment and for this reason the alloy is supplied in the precipitation-hardened condition. A data sheet (1300:332) giving details of the characteristics of the alloy, and the forms in which it is obtainable, is available.

Hayes Tracemaster Machine for Turbine Rotors

The illustration shows a close-up view of a special indexing work-holding fixture mounted on the table of a Tracemaster type TM. 43 hydraulic copying machine which has recently been built by Hayes Engineers (Leeds), Ltd., Gelderd Road, Leeds, 12, for profile milling turbine blades from the solid, in rotors up to 20 in. diameter.

The set-up is generally similar to that on the Tracemaster type TM. 32A machine built by the company for copy milling turbine blades in rotors for de Havilland Spectre rocket motors, which was described in MACHINERY, 94/378 — 18/2/59, except that two tracer heads are provided. One of these heads controls the movements of the table knee for milling the required cross sectional shape on the individual turbine blades, and the other provides for copy machining a conical form at the root. Details of the Tracemaster type TM.43 machine were given in MACHINERY, 94/1308—10/6/59.



Set-up for milling turbine blades from the solid on a Hayes Tracemaster type TM.43 machine

Barrel Finishing Operations on Bearing Rollers

Almco Supersheen Equipment Installed at the East Works, Daventry, of the British Timken Division of the Timken Roller Bearing Co.

IN FIG. 2 IS SHOWN one of two type DB. 400 barrel finishing machines built by Almco Supersheen Division of Great Britain, Ltd., Bury Mead Works, Hitchin, Herts., which have been installed at the East Works, Daventry, of the British Timken Division of the Timken Roller Bearing Co., for de-scaling and polishing heat-treated bearing rollers for axle boxes, in readiness for grinding.

These machines, which are situated close to the discharge end of the continuous shaker hearth heat treatment furnace, are maintained in continuous operation 24 hours a day, and handle bearing rollers at the rate of 40,000 per week. Each has a volumetric capacity of 20·8 cu. ft., and the octagonal barrel, which is 48 in. long by 30 in. across flats, is divided into two compartments, and can be driven at steplessly-variable speeds from 8 to 30 r.p.m. The individual bearing rollers weigh approximately 4 oz., and a load of components which has a total weight of 300 lb. is handled in each compartment on the barrel finishing machine.

Bearing rollers are continuously discharged from the heat treatment furnace, and are fed by way of an inclined chute into the upper end of the unit shown in Fig. 1, which has been specially designed

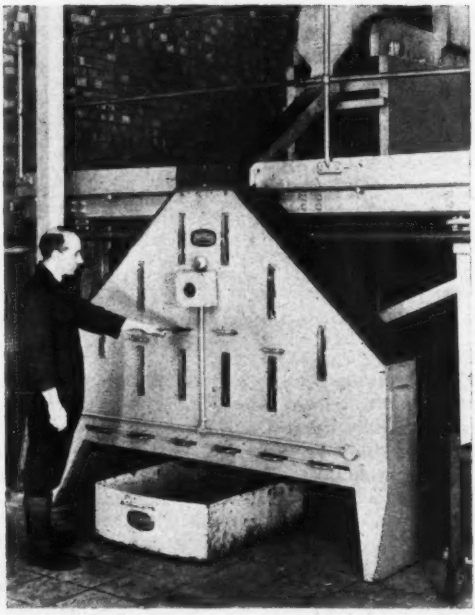


Fig. 1 (above). From the heat treatment furnace, bearing rollers are delivered to this unit, which has been specially designed for collecting and storing loads of components, each weighing 300 lb., in readiness for barrel finishing

Fig. 2 (left). One of two Almco Supersheen type DB. 400 barrel finishing machines which have been installed at the East Works, Daventry, of the British Timken Division of the Timken Roller Bearing Co., for de-scaling and polishing heat treated bearing rollers in preparation for grinding

for preparing individual loads of components for barrel finishing. The unit incorporates 10 compartments, each of which will accommodate sufficient bearing rollers to form one load for barrel finishing. When the two topmost compartments have been filled, rollers are passed down inclined guides to the next lower compartments. If no rollers are removed from these compartments for barrel finishing, this procedure continues until six compartments have been filled, and other rollers are then discharged into pockets at the ends of the unit. When a maximum of four rollers has been passed into these pockets, a limit switch is energized to operate a bell and a flashing signal lamp. Rollers in any of the four upper compartments can then be discharged into the compartments in the lowest row by gravity, upon withdrawal of one or more sliding-type gates. Finally, rollers in any of the compartments in the lowest row, or either of the outer compartments, can be discharged into a container placed on the shop floor beneath the unit, as shown, by withdrawing one of six lower gates. The individual compartments in the unit are lined with ¼-in. thick abrasive-resistant rubber to reduce noise.

Barrelling media are loaded into the container at the end of a preceding barrel finishing operation, as will be explained later. The container is moved by a motor-driven hoist to the barrelling machine for loading the charge into one of the compartments. De-scaling compound is then added, and water is supplied through the hollow shaft of the machine. For the de-scaling operation, which occupies approximately 2 hours, the barrel is driven at a speed of 19 r.p.m. At the end of this operation, the barrel is stopped, and after a door made from perforated material has been attached to the loading aperture, water is again passed through the hollow shaft for rinsing the rollers and media. Polishing compound is then added, and the barrel is driven for a period of 1 hour at a speed of 15 r.p.m., for the finishing stage. When polishing has been completed, the rollers are again rinsed and the door is removed from the barrel. The barrel is now "inched" slowly, for discharging the rollers and the barrelling media on to a motor-driven separating screen. From the screen, which is located beneath the barrel, media are passed by way of baffles into a work-loading container mounted on the shop floor below the machine, as may be seen in Fig. 1. Completed rollers are then discharged into a de-watering bath by way of an inclined chute at the end of the screen, as shown in Fig. 3. Finally, the rollers are transported to the grinding department by a continuous conveyor which passes through the de-watering bath.

The entire installation can be tended by one operator, and since the unit shown in Fig. 2 provides for the storage of a large number of rollers, barrel finishing can proceed in the event of an interruption in the production of components before or during heat treatment.

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Fig. 3. Following de-scaling and polishing, completed bearing rollers are passed into a de-watering bath by a chute at the end of the separating screen

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ULTRAGRAPH RECORDER.—The ABEM Company, Stockholm, Sweden, who are represented in this country, the Commonwealth, the U.S.A., and certain European territories by Smiths Industrial Division, Chronos Works, North Circular Road, London, N.W.2, have recently introduced a new ultragraph which can be employed for recording a wide variety of physical phenomena, within a frequency range extending from d.c. to 5,000 cycles per sec.

The instrument provides 14 separate channels for recording stress, strain, vibration, oscillation, displacement, pressure and temperature changes, for example, also other related events which lend themselves to conversion into electrical signals.

Particularly intended for use in research and industry, the unit incorporates ultra-sensitive galvanometers which, for many applications, eliminate the need for intermediate amplifiers. Recordings are made on special sensitized paper, and it is stated that no subsequent processing is required for the latter.

Detect-A-Tool Proximity Tool Protection System

On automatic transfer machines, the immediate detection of tool breakage prevents damage to tooling at subsequent stations, and reduces scrap losses. Failure to detect a broken drill at one station, however, may often result in the breakage of a tap or reamer at the next.

Among the detection systems now available, is the Detect-A-Tool which has been developed by Machinery Electrification Inc., Northboro, Mass., U.S.A. Equipment required for this system comprises a sensing element, an oscillator unit, a master control unit, and a limit switch. The sensing element is in the form of a toroidal coil enclosed in a steel housing which encircles the tool, as indicated at *A* in Fig. 1. This housing is sealed and provides protection for the coil against damage from coolant and swarf.

A cable leading from the sensing element is Neoprene covered, and is usually enclosed in a steel conduit clamped to the drill bush plate. The cable is connected to terminals on the oscillator unit, to which it is tuned. For each sensing element there is a separate oscillator unit, which operates in conjunction with a master control whereby a comparison is made between the actuation of a limit switch and the arrival of the tool within the sensing element. The limit switch provides a "check now" signal, and a corresponding "tool present" signal must then be received from the sensing head. If the tool is broken or does not enter the sensing element for any other reason, no signal is received and the master control relay is energized.

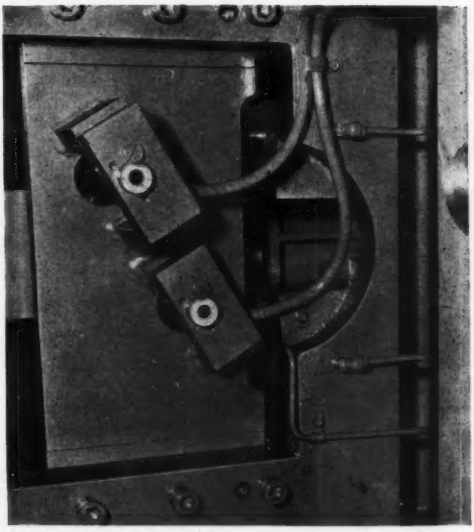


Fig. 2. This close-up view shows the method employed for mounting two sensing heads in different planes on a drill bush plate

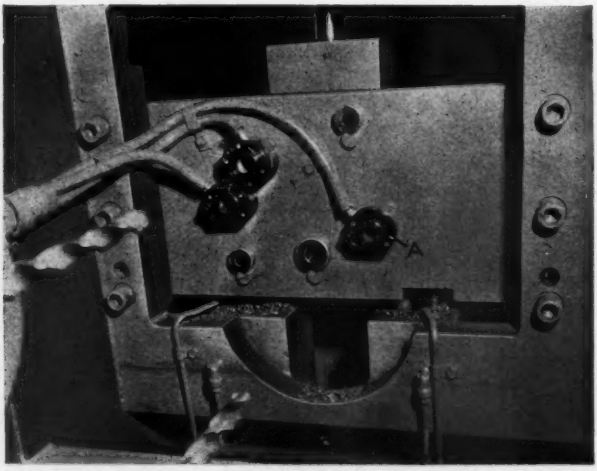


Fig. 1. Application of three Detect-A-Tool sensing heads on the drill bush plate of a transfer machine

A single master relay can be used with as many as 30 oscillator units. The limit switch contacts close when the point of the tool enters the field of the sensing coil during the in-feed movement, and they remain closed until the point is retracted beyond the "detect" position. When the holes in a group are of the same depth and require drills of the same length, each bush is retained by an adapter which serves as a mounting for the sensing head, as shown in Fig. 1. Three sensing heads can be wired to one oscillator, but if more than three drills of the same length require to be

checked, additional oscillators must be employed.

When the drills are not of the same length, it is necessary to mount the sensing heads in different planes as seen in Fig. 2. The heads are so arranged that the point of each drill is in its correct position at the instant when the in-feed "check now" limit switch closes. Where the drills are of widely different lengths, this arrangement is not possible, and two limit switches operating in conjunction with two master controls must be employed.

Where a sliding bush plate is employed to provide clearance for the movement of the work from station to station it may be possible to eliminate the limit switch, since the drill does not require to be withdrawn completely from the sensing unit. If the drill is broken, a signal is automatically transmitted to the control unit.

Variations in voltage, oscillator tube characteristics, and temperature can all affect the accuracy of the proximity detector equipment. For the sake of simplicity, however, no electrical adjustments are provided since the variation in detectable tool length attributable to all factors combined is stated not to exceed $\frac{1}{16}$ in. Thus, if the tool is allowed to extend $\frac{1}{16}$ in. within the active plane of the sensing head at the moment when the limit switch is actuated, false tripping of the warning relay equipment will be avoided. It is claimed that, in a given installation, it is possible to adjust the limit switch to detect changes in tool length of 0·005 in. under constant-line voltage conditions.

Machining Die Cast Motor Housings for Floor Polishers

At the works of the Regina Corporation, Rahway, N.Y., U.S.A., four Heald type S Bore-Matics perform a total of 19 operations on motor housings for floor polishing machines. It is stated that as a result of installing these machines production was increased by 33 per cent, and labour costs were reduced by 66 per cent; moreover, the installation occupies only half as much space as was required with the previous arrangement.

One operation — line reaming — has been eliminated. A further advantage is that the two sections which comprise the housing are now being machined to an accuracy which has made selective assembly unnecessary. The housings are completed at a rate of 250 per hour, and it is stated that scrap is well below 1 per cent.

The machines are arranged in pairs, face to face, as seen in Fig. 1, and one pair is employed for roughing and finishing fan sections, and the other for roughing and finishing field sections. Only two operators are required, one tending each pair of machines. Two others give assistance on a part-time basis with setting up and tool maintenance.

Both sections are zinc die castings (SAE alloy 903, ASTM AG40A) and they are held together by three screws. On the fan-section roughing machine, shown in Fig. 2, a ⅞-in. hole for the armature-shaft bearing is reamed, a bronze bushing is pressed into the hole, and a ¾-in. radius relief is milled in the bushing to accommodate

Fig. 1. Field sections of motor housings are roughed and finished on this pair of Bore-Matics, which are tended by one operator

the drive gear. The cycle is completed in 14 sec.

When the fan section is transferred to the finishing machine, a diameter is turned and shoulder faced. Next, a hole for the packing gland is counterbored, and the bushing pressed in on the first machine is reamed. After a hole for an adjusting screw has been tapped, the spindle-bearing hole is reamed and counterbored at a single stage. All finishing operations are performed in 19 sec.

On the Bore-Matic for the first series of operations on the field section, the bearing hole is reamed, a bushing is pressed in, two 10-24 stud holes for brushes are tapped, and a ¾-in. radius is milled in the bushing for gear clearance. The cycle time is 14 sec.

Six finishing operations on the field section are completed by a multiple tool. These operations comprise boring the field diameter, facing a shoulder, turning an outside diameter, counterboring the packing-gland hole, and reaming the armature-shaft bushing. The counterboring and reaming of the spindle-bearing hole are also performed at one operation stage, with a step tool. For these operations the cycle time is 19 sec.

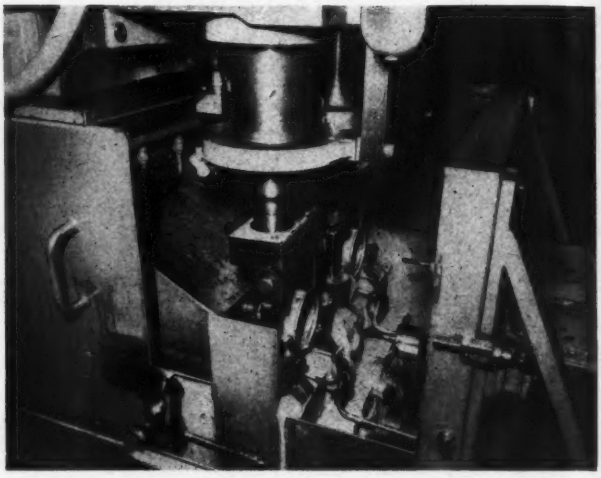
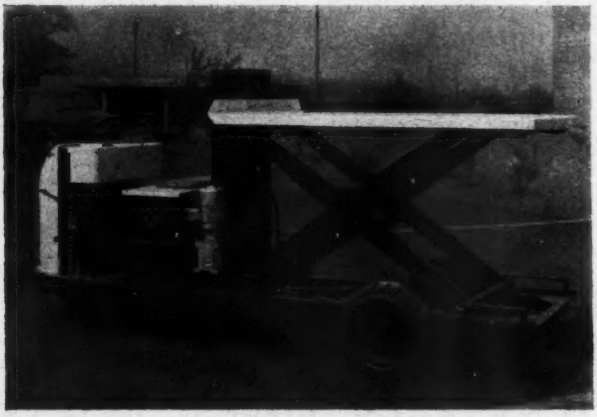


Fig. 2. Close-up view of the Bore-Matic machine for roughing operations on fan sections of motor housings, showing the clamping arrangements and tooling

New Brush Industrial Truck

In the accompanying figure is shown a new battery-powered industrial high-lift platform truck which has recently been added to the range made by the Brush Electrical Engineering Co., Ltd., Loughborough, a member of the Hawker Siddeley Group. Of 2 tons capacity, the truck has a platform measuring 3 ft. 6 in. wide by 5 ft. 6 in. long, which can be raised and lowered to give minimum and maximum heights of 1 ft. 7 in. and 4 ft. 1 in. above ground level. Movement of the platform is effected by a single-acting hydraulic ram, in conjunction with two lifting chains and pulleys mounted in the ram head. Control of the platform movements is by push-button.

A safety interlock is incorporated whereby power to the road wheels is automatically cut off while the platform is being raised and lowered. The truck is steered by the single wheel and has a turning radius of 8 ft. 2½ in. An important feature of the new truck is its low running cost, which is claimed to be of the order of 8d. to 1s. per normal working day.



New high-lift platform-type industrial truck introduced by the Brush Electrical Engineering Co., Ltd.

NEW PRODUCTION EQUIPMENT

Edited by
G. W. Mason
and
A. J. Barker

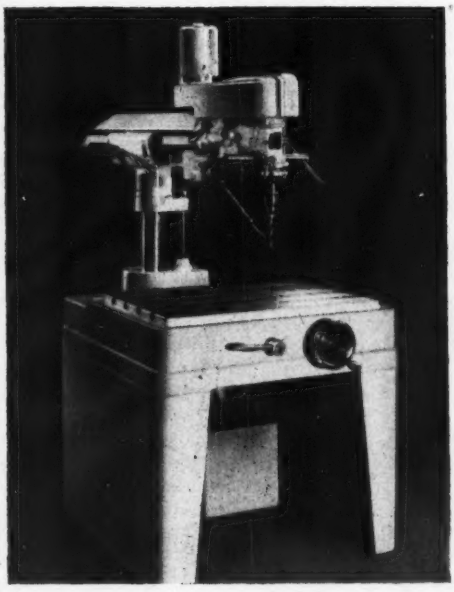
Tornado Radial Arm Drilling Machine

Recently introduced by Cooper Bros. (Stockport), Ltd., Shrewsbury Street, Stockport, the Tornado radial arm drilling machine seen in the figure can be equipped with a spindle head which has a capacity from 0 to ½ or ⅛ to ⅝ in. diameter, and provides for drilling to the centre of a 67-in. diameter circle.

A Tornado quick-change or a standard Jacobs chuck can be mounted on the spindle, the former unit permitting drills to be changed without the need for stopping the head. A steplessly-variable range of spindle speeds from 330 to 3,300 r.p.m. is provided, 18 selected speeds being indicated, and changes are made without stopping the drive.

The head can be swivelled 45 deg. either side of the vertical position, by reference to a graduated scale, and the arm on which it is carried can be adjusted radially. This arm is supported by means of strips that extend along both sides and engage a total of eight grease-packed, shielded needle roller bearings, mounted in a housing. For swivelling, the latter is carried on two pre-loaded taper roller bearings at the top of the 4½-in. diameter column. A single, conveniently-placed lever provides for the operation of clamps for locking the housing and the arm, after setting. The well-ribbed work-table has a T-slotted surface measuring 36 by 26 in., which is surrounded by a coolant trough.

The machine is built to Schlesinger limits, and all the rotating components are dynamically balanced, and the sliding surfaces are either precision ground or hand scraped.



Tornado radial arm drilling machine

New Automatic Work Loading Equipment for Red Ring Gear Shavers

The National Broach & Machine Co., Detroit, Michigan, U.S.A., have recently introduced automatic work loading equipment of the in-line type for use on their GCU rotary gear shaving machines of 8-, 12-, and 18-in. capacity.

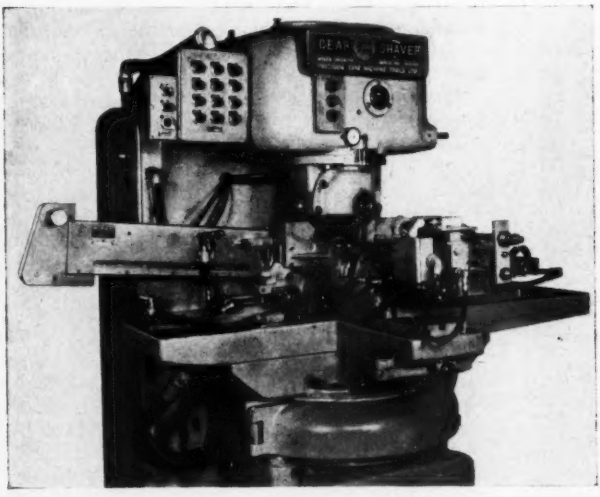
This equipment will handle gears of fairly large diameter, and enables components to be readily passed from one machine to another if required. It is here shown set up on a Red Ring gear shaving machine for loading helical camshaft timing gears of 5·8793 in. pitch diameter. Gears may be passed towards and away from the shaving position in a direction from left to right or vice versa, as required, depending upon the design of the equipment, and when the machine is being set up, the cutter head, and air-operated tailstocks for holding the work, are swivelled through 90 deg. to the position shown.

When the equipment is in use, gears to be shaved are passed between a pair of gauging gears at the upper end of an inclined magazine chute, which serve to check the pitch diameter. Any gears which exceed the specified diameter, are prevented from entering the chute, so that the risk of damaging the cutter is avoided. For loading, the chute is advanced in a direction towards the shaving cutter by an air cylinder, and the leading

gear at the lower end is transferred to the shaving position by a jaw assembly. At the same time, a gear on which shaving has been completed at the previous working cycle is transferred by another jaw assembly from the shaving position to a second chute, at the opposite side of the cutter head, down which it is discharged from the machine. Next, the tailstocks are operated to hold the fresh component, and the jaw assemblies, which are actuated by a separate air cylinder through links, are moved clear. Finally, the first chute is returned to the starting position, to complete the loading operation.

Automatic work loading equipment is available for Red Ring gear shaving machines, which incorporates upper and lower inclined magazine chutes, mounted at the front of the work-table. Components on which machining is to be carried out are passed to the shaving position by way of the upper chute in a direction towards the column of the machine. When shaving has been completed, the component is returned towards the front of the table, to be discharged by way of the lower chute. Equipment of this type, set up on a Red Ring gear shaving machine, for handling long slender parts, was described in MACHINERY, 96/842—13/5/60.

The National Broach & Machine Co. are represented in this country by an associate company, Precision Gear Machines & Tools, Ltd., Bodmin Road, Wyken, Coventry.



Close-up view of a Red Ring gear shaving machine fitted with the recently-introduced in-line automatic work loading and unloading equipment for handling camshaft timing gears of 5·8793 in. pitch diameter

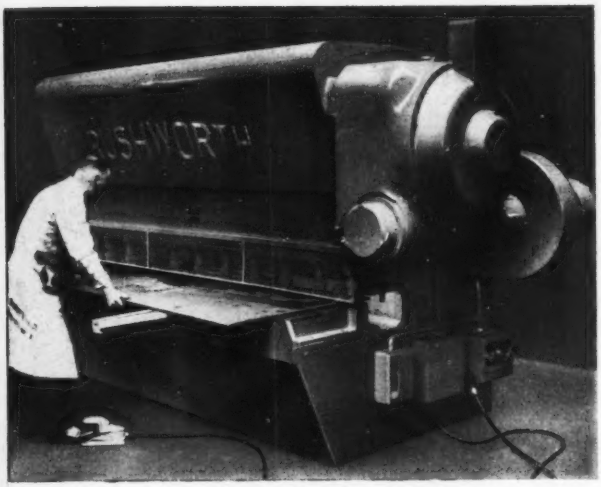
Rushworth Series 38 and Series 50 Guillotine Shearing Machines

Rushworth & Co. (Sowerby Bridge), Ltd., Clough Works, Sowerby Bridge, Yorks, have recently introduced the series 38 and series 50 guillotine shearing machines, which incorporate a number of design improvements. The series 38 machines, which will cut mild steel up to ⅜-in. thick, are available in 6-, 8-, 10-, and 12-ft. capacities, and the series 50, for ½-in. thick plate, are built in 6-ft. and 8-ft. sizes. The No. 838 machine, of 8-ft. by ⅜-in. capacity, is shown in the figure. It was demonstrated at the recent Engineering, Marine, Welding and Nuclear Energy Exhibition, Olympia.

These guillotines are of all-steel construction, and the slideways have a 2-deg. forward slope so that, on the downward stroke, the ram simultaneously moves back. With this arrangement, a clean edge, sheared at right angles, is obtained on the plate. Drive is taken from a motor of 15 h.p., through worm and wormwheel and a multi-tooth dog clutch of the "one-revolution and stop" type. The clutch is actuated by a solenoid-operated plunger and either a foot switch or a pendant control can be provided. Dual-purpose anti-friction bearings are provided for the worm-shaft, which runs in an oil bath. A one-shot lubrication system is incorporated for other bearings and working surfaces.

Low rake angle of the top blade prevents curling of the plate being cut, and both the top and the bottom blades have four cutting edges. A mounting block is provided for the bottom blade which can be adjusted over its full length to enable the blade clearance to be accurately set. The hold-down comprises a series of hydraulic plungers supplied with oil from a master cylinder, the piston of which is actuated by a cam on the crankshaft.

Two side guides are provided for mounting on the top of the table, and two support brackets for attachment at the front. A plain back gauge is normally fitted, but a precision back gauge, with graduated dials, can be provided if required. Alternatively, a power-operated back gauge, controlled by push-buttons in conjunction with an indicating dial, at the front of the machine, can be fitted. Lighting is provided for the cutting area, and there is a chute for waste at the rear.



Rushworth type No. 838, guillotine shearing machine of 8-ft. by ¾-in. capacity

Extra equipment available includes 4-ft. long table brackets with floor supports, a squaring arm 4, 6, 8 or 10 ft. long, a shadow cutting line indicator, and blades of a special quality which are suitable for cutting stainless steel sheets.

Each of the guillotines in the range has a 9-in. deep gap, and on the machine shown the maximum width cut with the back gauge fitted is 24 in.

Waterbury Farrel No. 10 Hi-Pro Cold Heading Machine for Tubular Rivets

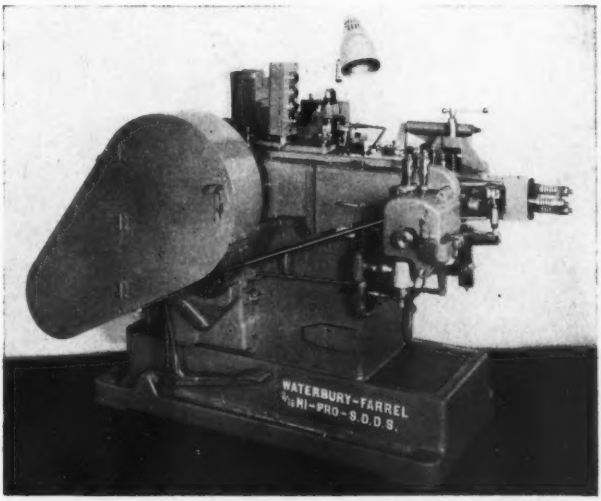
In the figure is shown the No. 10 Hi-Pro cold heading machine for tubular rivets, which has been added to the range built by the Waterbury Farrel Foundry & Machine Co., Waterbury, Conn., U.S.A.

This machine has a capacity for producing tubular rivets with shank lengths up to 1 in. from wire of $\frac{3}{16}$ in. maximum diameter. For making the rivets, a single die is employed in conjunction with two punches mounted on a slide which is moved in the vertical direction to different working positions during the operating cycle. With this arrangement, the need for a work transfer mechanism is avoided, and rivets are produced at alternate working strokes at a maximum rate of 200 per min. Drive is taken from a 5-h.p. motor, and the machine has a rating of 30 tons.

Pieces up to 1½ in. long can be cut from the work material, and the cam-operated feed mechanism is set for working stroke with the aid of graduations on a crank disc. Settings for shank length of the tubular rivets to be produced are made by means of a conveniently-placed backing screw, and the punch slide can be adjusted towards and away from the die by a wedge arrangement. Provision is also made for adjusting the punch slide sideways and in the vertical direction. Completed rivets are removed from the die by a stripper, to be discharged from the machine by way of an inclined chute, and any incorrectly-formed components are passed into a separate container. Since the die is held in a split block, it can be readily removed and replaced when the set-up is to be changed.

The machine occupies a floor space of 32 by 60 in., and weighs approximately 1 ton 13 cwt.

Waterbury Farrel cold heading machines are



Waterbury Farrel No. 10 Hi-Pro cold heading machine for tubular rivets

H2

handled in this country by George H. Alexander Machinery, Ltd., 82-84 Coleshill Street, Birmingham, 4.

Kitchen-Walker Horizontal Facing, Boring and Turning Machine

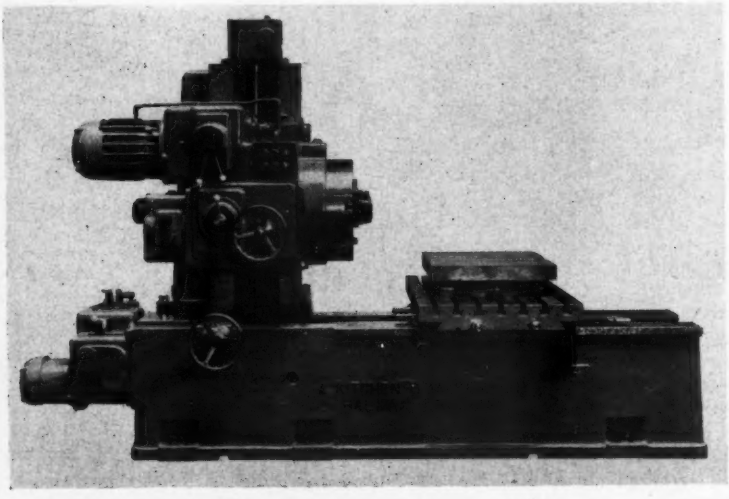
The horizontal facing, boring, and turning machine shown in the accompanying illustration has recently been introduced by A. Kitchen-D. Walker, Ltd., Hexagon Works, Pellon Lane, Halifax, for performing operations on pipe flanges, valve bodies and other circular components.

Main drive is taken from a 7½-h.p. constant-speed motor through a gearbox which provides nine speeds from 17 to 216 r.p.m. for the facing head, and finally through helical gears. When the "stop" push-button is pressed, the facing head is brought to rest in 3 sec. irrespective of the speed at which it was driven. The head is mounted on large-diameter, pre-loaded, taper roller bearings, and two radial feeds, namely $\frac{1}{32}$ and $\frac{1}{16}$ in. per rev., are provided in each direction for the facing slide by a scroll-type mechanism. The feed is automatically disengaged when the facing slide has been brought to the extreme ends of its travel. In addition, the facing slide can be adjusted by handwheel, when the head is rotating if required, motion being transmitted by a differential gear unit, and a micrometer dial is provided to facilitate accurate setting. The spindle head can be adjusted for a distance of 18 in. on the column ways.

A maximum travel of 36 in. is provided for the main 42- by 30-in. work-table on the bed-ways, and feeds of ½, 1, and 1½ in. per min., also rapid power traverse at rates of 24, 48 and 72 in. per min., are available in each direction. Cross adjustment, for a maximum distance of 30 in., is applied by hand. Indexing tables which have top surfaces of 24 or 36 in. square or diameter are available for mounting on the main table. Each table can be readily set in different positions at 90 deg., and to facilitate indexing, the top portion can be raised clear of the base, and is then easily turned by hand, on ball bearings.

Gears and bearings in the spindle head and the feed gearbox are automatically lubricated by built-in pumps, and a "one shot" system is provided for delivering lubricant to the table guideways. Double locks are fitted for securing the spindle head and table in the required positions.

The machine weighs 5¼ tons, and occupies a floor space of 11 ft. 3 in. by 4 ft. 6 in.

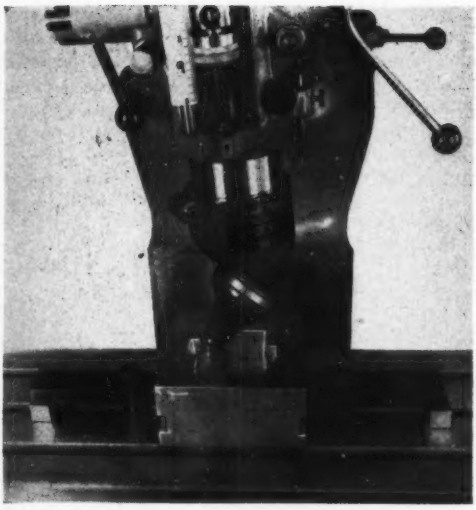


Kitchen-Walker horizontal facing, boring, and turning machine

Bridgeport Quillmaster Angular Milling Attachment

The range of extra equipment that is available for use with the Bridgeport turret milling machines built under licence by Adcock & Shipley, Ltd., P.O. Box No. 22, Ash Street, Leicester, has been extended recently by the addition of the Quillmaster attachment, which is mounted on the quill of the milling head in the same manner as the right-angle unit. With this attachment, the spindle housing is mounted eccentrically on an inclined swivel slide, and can be set with the cutter axis at any angle between the vertical and horizontal positions.

Designed for use on the type J heavy-duty milling head, the standard attachment incorporates a step-up drive transmission, to provide a maximum spindle speed of 3,600 r.p.m., and in the accompanying illustration, is shown arranged for milling a small radius at a corner of a deep mould cavity. For this operation, the milling head is set to the vertical position. A ball-ended cutter is employed, and it will be seen that the spindle housing is adjusted to such an



The standard Bridgeport Quillmaster angle milling attachment is here shown mounted on a type J turret head

angle that there is no risk of marring the adjacent surfaces. The type MA attachment is intended for use on the cherrying unit, whereby a die-sinking cutter is moved through an arcuate path, and drive is transmitted to the spindle in the ratio of 1:1.

Bullard Dynamill Horizontal Boring Machine

In Fig. 1 is seen an example from the range of Dynamill horizontal boring machines, which are built by the Bullard Co., Bridgeport, Conn., U.S.A., for whom the agents in this country are Buck & Hickman, Ltd., Otterspool Way, Watford By-Pass, Watford, Herts. The machine is built with spindle diameters of 3, 4, or 5 in., and can be supplied with a work-table of one of five standard sizes, from 36 by 60 in. to 60 by 132 in. Bed lengths range from 60 to 144 in., in five steps, and there is a choice of four traverses for the boring head on the column, from 50 to 86 in. The design of the machine, it is claimed, enables maximum advantage to be taken of modern cutting tool materials, and ensures that maintenance work is reduced to a minimum and is readily performed. If required, the machine can be supplied with General Electric Mark I equipment, whereby the table and boring head are positioned automatically, under the control of tape, or by means of data which are supplied with the aid of a manual digital input system.

Drive to the boring head is taken through a hydraulically-operated clutch and brake system, which is automatically adjusted to compensate for wear, and a total of 28 spindle speeds is provided by a planetary arrangement of new design. Final drive is transmitted to the spindle through double helical gears, and the direction of rotation can be reversed by means of a toggle switch. Axial motion is imparted to the spindle by a double rack, to ensure maintenance of alignment, and it is moved through hardened tool-steel bushes, which are tapered and can be adjusted for taking up clearance in the sleeve. A hydraulically-operated drawbar, with a milling machine taper at the nose end, is mounted in the spindle, to facilitate tool changing.

The table and the saddle are traversed on replaceable steel guide strips, which are precision ground and hard chromium plated, and are retained in their grooves by rolling-in a copper alloy binder metal. To provide for clamping these slides after positioning, also the boring head, sheet metal bellows are incorporated in the gib assem-

Fig. 1. An example from the range of Bullard Dynamill horizontal boring machines

blies, and these units are expanded hydraulically.

Steplessly-variable feeds from 0 to 0·125 in. per rev. of the spindle and 0 to 108 in. per min. are available, and can be changed while cutting is in progress, and rapid traverse can also be obtained. All the feed screws engage double nuts, which are made from a phenolic anti-friction material, to ensure that backlash and wear are kept to a minimum. Stops are provided, to enable the saddle to be rapidly traversed to pre-determined positions, and the machine is equipped with the company's Size-Au-Trol depth control system, for automatically disengaging feed or rapid traverse during axial movement of the spindle. With this system, discs on a rotating drum trip switches, to operate a solenoid valve for stopping the motion.

Ease of operation is a feature of the machine, and the principal motions are controlled from a small pendant unit. A close-up view of this unit is shown in Fig. 2, and all the traversing movements are selected by means of four push-buttons mounted in a 2-position indexing turret. After this turret has been set and the appropriate button depressed, rapid traverse for movement of the selected member in the required direction is engaged by means of a trigger projecting from the under-side of the unit, and is obtained at one of four rates, depending on the pressure applied. A pre-determined creep rate is obtained when the trigger is released, and with this arrangement, the traverse speed can be progressively reduced as the member approaches the desired position. The trigger is pushed away from the operator for engaging the pre-selected feed rate. Spindle speeds are selected by means of two push-buttons at the right-hand side of the unit, the speed in use being indicated on a dial on the boring head, and for engaging the drive and stopping the spindle there are two other buttons.

Fig. 2. On the machine shown in Fig. 1, this pendant unit provides for rapid movement of all the traversing members at four rates, also a creep rate, engagement of feed, controlling the spindle drive, and selecting the speed

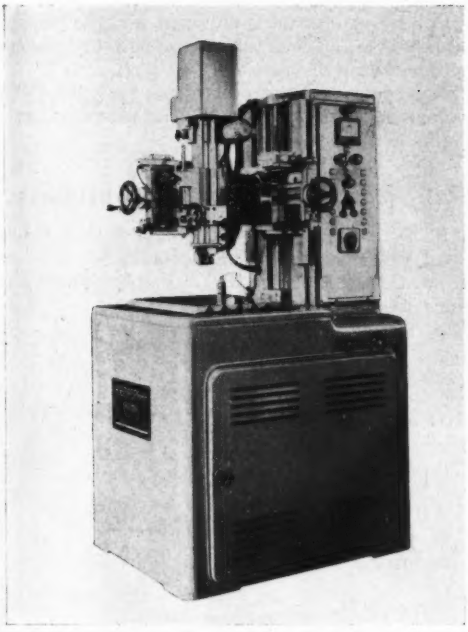
To provide for rapidly setting the table, saddle, boring head and spindle, the positions of these members are continuously indicated by separate clock-type dials, two of which are visible in Fig. 2. Each dial has a black pointer, which makes one rev. over an inner scale for a movement of the associated slide through a distance of 100 in., and black and red pointers that complete one rev. over an outer scale for movements of 10 and 0·1 in., respectively. The position of the member can be determined to an accuracy of 0·0005 in. with this arrangement, it is stated, and the dials can be adjusted for altering the reference point from which measurements are taken. Motion is transmitted to the dials associated with the head and the saddle by precision racks, and it is claimed that readings are obtained with a repetitive accuracy of 0·0002 in. A further dial, with a single pointer, is provided for indicating the position of the steady bearing, which is adjusted vertically on the boring stay in synchronism with movement of the boring head. The relative positions of the two members may thus be compared, and the steady bearing can be adjusted finally by a hand crank, to correct any misalignment.

To ensure that the accuracy of the machine is not affected by any temperature rise in the hydraulic system, oil is drawn from a reservoir which is not connected with the bed. The range of extra items which is available includes equipment for facing, with provision for steplessly varying the feed rate, and attachments for right-angle milling, screw-cutting, and contouring.

Agemaspark F 500 Spark Erosion Machine

Improvements have been made to the design of the Swiss-built Agemaspark F 500 spark erosion machine, which has a maximum power consumption of 3 kW. and is marketed in this country by Adam Machine Equipment, Ltd., Forrester House, St. Peters Street, St. Albans, Herts., and the latest version is shown in the illustration.

The dielectric tank, which can be raised or lowered—under push-button control—in 15 sec., has been enlarged, and to facilitate the circulation



The latest version of the Agemaspark F 500 spark erosion machine

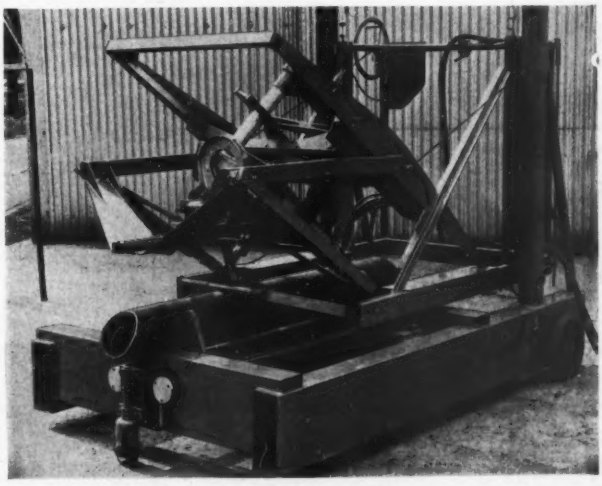
of the increased quantity of fluid now employed, the pump and filters have been re-positioned. The enlarged and strengthened column has been extended, and now encloses the motor whereby the electrode head is adjusted vertically. To provide for more sensitive down-feed for the electrode, the gearing whereby drive is transmitted from the associated servo-motor has been re-designed.

Tubefile No. 18 Automatic Tube Profiling Machine

Recently introduced by General Precision Systems, Ltd., Bicester Road, Aylesbury, Bucks., the Tubefile No. 18 machine, here shown, provides for profile cutting, without the need for templates, the ends of steel tubes which are to be welded to other tubes at included angles down to 30 deg. Multiple profiles can be cut, to provide for the intersection of several branch tubes at a common point, and adjustment is provided for the notch angle (the angle between the cut and the tangent to the main tube at the point of contact) and for off-setting, as required when the axes of the branch and main tubes do not intersect.

The machine is designed for operation on an automatic cycle, and cutting is performed by an oxy-acetylene torch, which is swung through a full circle about the workpiece, the flame being extinguished after completion of the profile. With this arrangement, the need for passing the workpiece through a chuck during loading and unloading is avoided. Rollers are provided to facilitate rough centring, and alignment of the work longitudinally, after it has been placed on the base, and it is then positioned accurately by means of lever-operated centring jaws. The counterbalanced profiling mechanism, which is supported by two braced pillars, is then lowered until a lateral bar is brought into contact with the upper surface of the work, to set the centre about which the cutting torch will be swung. After the cutting flame has been ignited and stabilized, the operating cycle is initiated by means of a push-button. Provision is made for altering the speed of the torch while cutting is in progress, to compensate for variation of the depth of cut, and in the event of the cut being lost during the cycle, a second push-button provides for returning the torch to the position at which the failure occurred.

Profiles to suit main tubes from 18 in. down to 6 in. diameter can be cut with an average accuracy of $\frac{1}{8}$ in. and branch tube diameters may range up to 18 in. There is no theoretical lower limit to branch tube size, but it would not be economic to



Tubefile No. 18 automatic tube profiling machine

deal with tubes of less than 4 in. diameter on the machine. Work up to 12 ft. long can be accommodated without the need for additional rests, and provision is made for extending the centralizing arrangement when longer tubes have to be profiled.

Sala AB 60e Cold Sawing Machine

Distributed in this country by Soag Machine Tools, Ltd., Juxon Street, London, S.E.11, the Italian-built Sala AB 60e bench-type high-speed cold sawing machine shown in the figure has capacity for cutting circular-section material up to 2¾ in. diameter, at angles of 90 and 45 deg. As an indication of the speed of operation, it is stated that steel bars of 1½ in. diameter and with a rectangular section measuring 1½ by ¼ in. are cut in 30 and 7 sec., respectively, without the formation of burrs.

Cutting speeds of 132 and 265 ft. per min. are obtainable, and drive to the spindle, which runs in adjustable taper roller bearings in the pivoted sawing head, is taken from a motor at the rear, through a gearbox with hardened, oilbath-lubricated gears. A stop is provided to control the depth of feed, and the entire head can be swivelled about a vertical axis to a maximum angle of 45 deg. on either side of the central position. Of patented design, the vice provides full support for the work when cutting at any angle in the range, and the 2-position jaw pads enable angle-, T-, flat-, and round-section material to be gripped securely. The adjustable length stop can be swung clear of the work and returned by means of a lever.

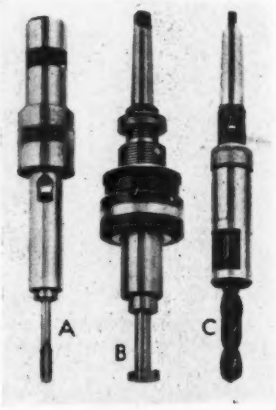
Sala AB 60e bench-type cold sawing machine

Coolant equipment is provided, and the machine occupies an area of 26 in. square and weighs approximately 2½ cwt.

A larger machine, designated type AB 100e, which will accept work up to 4 in. diameter, is also available.

Scully-Jones Quick-change Tool-holders

B. O. Morris, Ltd., Morrisflex Works, Briton Road, Coventry, have been appointed sole licensees in the United Kingdom and E.F.T.A. countries for the manufacture, importation and sale of the range of quick-change, pre-set tool-holders developed by Scully-Jones & Co., Chicago, Ill., U.S.A.



Examples from the range of Scully-Jones quick-change, pre-set holders for cutting tools

These tool-holders, originally introduced for use on automatic transfer machines, are now being applied with advantage on various standard types of machine tools. Some examples from the range are shown in the accompanying figure. The tool-holder at *A* is for taps, and incorporates an adjustable slipping device for protection against breakage. At *B* is shown an automatic recessing tool which permits accurate undercut recesses to be produced on a repetition basis by unskilled labour. A drill-holder incorporating a micrometer adjustable depth stop and arranged for quick changing is seen at *C*.

All tool-holders in the range can be employed in connection with the Scully-Jones Toolitrol system for the control of tool changing on transfer and other types of machine tools. Sharpened and pre-set tools are stored ready for immediate change-over, so that down time is kept to a minimum.

OMNIBUSES, COACHES AND TROLLEY BUSES (complete vehicles and chassis) built in the U.K. during May totalled 1,405 units, and 672 units were exported.

Producing Accurate Fine-pitch Gear Trains

Fig. 1. Precision gear train assembly produced by the Bosch-Arma Corporation, Garden City, N.Y., U.S.A.

In Fig. 1 is shown a precision gear train assembly for missile ground operational equipment which is being produced by the Arma Division of the Bosch-Arma Corporation, Garden City, N.Y., U.S.A. The gearbox and associated bearing cover are of cast aluminium.

To reduce the time required to finish machine the bores for the gears, a positive locating fixture plate was made for use on a Pratt & Whitney jig borer as shown in Fig. 2. This plate, seen more clearly at *A* in Fig. 3, is made of Pioneer DC929T aluminium alloy, hardened and stabilized. It has 36 holes at centres corresponding to those required in the workpiece, all the holes being of the same size, and accurately produced on a Swiss jig borer. The work is located on the fixture plate by dowels, and held by bolts which enter previously drilled holes.

An auxiliary table with a flat, ground, top surface, and mounted on short pillars, is clamped to the table of the Pratt & Whitney jig borer, to support the fixture plate which carries the work. The purpose of the pillars is to provide clearance beneath the table for a vertically-moving plunger, spring-loaded upwards, which moves in a hardened and ground steel bush in the centre of the auxiliary table. This plunger can be retracted by means of a hand lever, and it has a reduced-diameter end which fits the 36 holes jig bored in the work mounting plate. The holes in the work-plate, it may be noted, are not bushed.

Fig. 2. Pratt & Whitney jig borer with auxiliary table, used for boring 36 holes in the gearbox and cover

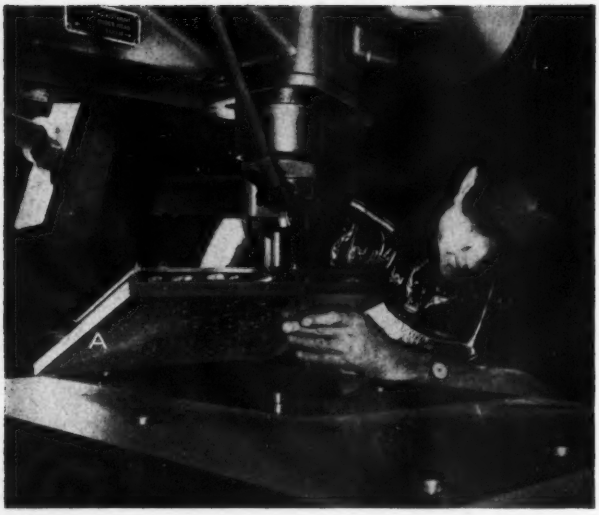


Fig. 3. View showing the bored fixture plate *A*, and the location pin in the auxiliary table

With this arrangement, it is only necessary to make one setting of the jig borer table, at the beginning of the operation, to bring the locating plunger in the auxiliary table accurately into line with the machine spindle. The table is then locked in position, and the locations of all the holes bored in the workpiece are determined by the master plate and plunger.

It is stated that with the method described, the time required to bore the 36 holes is only six hours. Five different sizes of holes are produced with the aid of pre-set cutters and the use of quick-change spindle adapters. The tolerance on the hole centres is 0·0002 in.

PRODUCING THE FINE-PITCH GEARS

The fine-pitch spur gears used in the instrument gearboxes shown in Fig. 1 afford another example of highly-accurate parts economically produced in relatively small quantities by the adaptation of standard equipment. It was a requirement that all parts produced by the company should be interchangeable with others made by sub-contractors. The standard specified for the gears in question was virtually that of master gears. It was found possible, however, to produce them on standard Barber & Colman No. 3 hobbing machines by paying close attention to machine maintenance and adjustment, and using suitably-designed work-holding arbors, developed by the company.

Also, care was taken to ensure that the blanks were flat and of uniform thickness, and the centre bore in each was machined to a tolerance of 0·0002 in. on a Heald Borematic. Typical of the components in the gearbox train, is a 100-tooth aluminium gear wheel of 64 d.p., and 14½-deg. pressure angle, with a pitch diameter of 1·562 in.

The hardened and ground steel components of the arbor assembly employed are shown in Fig. 5. The adapter *A*, which is fastened to the nose of the machine spindle, is provided with a front extension whereon is mounted a backing sleeve *B*, for the workpiece. This extension is also bored to take a stub mandrel *C*, on which the workpiece,

Fig. 4. Set-up on a Barber & Colman No. 3 hobbing machine for cutting fine-pitch gears

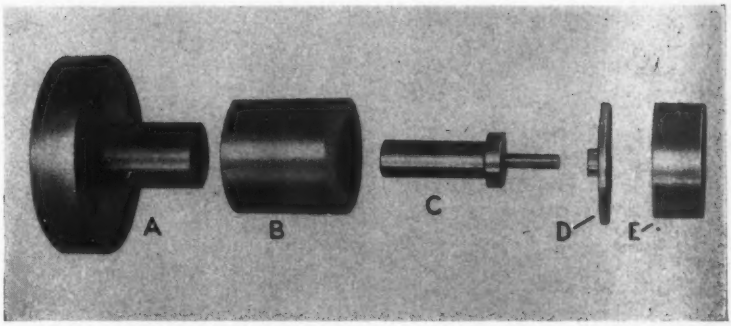


Fig. 5. Components of the work mandrel assembly used on the Barber & Colman hobbing machine

seen at *D*, is clamped by means of the collar *E*, and a screw and washer. Standard, ground-form, high-speed steel hobs are used, which are run at a speed of 200 surface ft. per min. Care is taken to move the hob to a new position before the cutting edges show any sign of dullness.

The accuracy obtained conforms to Class 3 of the A.G.M.A., and subsequent shaving is not necessary. It is stated that inspection on a Red Line gear checker shows a composite error consistently below 0·0002 in.

Colforg Equipment for the Production of Forging Slugs

Some details of the range of cold forging machines, and equipment for the preparation of slugs, made by Cold Forging, Ltd., and their associated companies, were given in MACHINERY, 98/308—8/2/61, and it was stated that a line for the quantity production of components by cold forging, was to be installed in the firm's works at 29 Hanworth Road, Sunbury-on-Thames, Middlesex. Equipment for the production of slugs for cold forging has now been brought into operation, and in Fig. 1 may be seen from left to right a Colforg cropping machine, a pre-forming machine, and a chamfering machine, which are connected by a chain-type conveyor to provide for fully-automatic working.

As was mentioned in the earlier article, the cropping machine is available in three sizes which have capacities for producing slugs from steel bar with maximum diameters of 1, 2, and 3 in. The bar is fed into the cropping tool at a small angle to the horizontal under end pressure applied by a carriage connected by a steel cable to a drum which is turned hydraulically, and the machine is operated continuously. A close-up view of the cropping tool is given

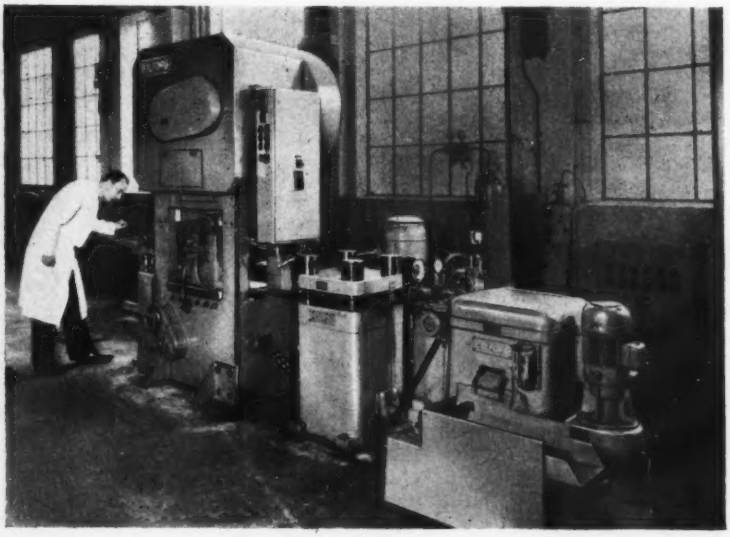


Fig. 1. This Colforg installation for the production of slugs for cold forging comprises a cropping machine, a pre-forming machine, and a chamfering machine

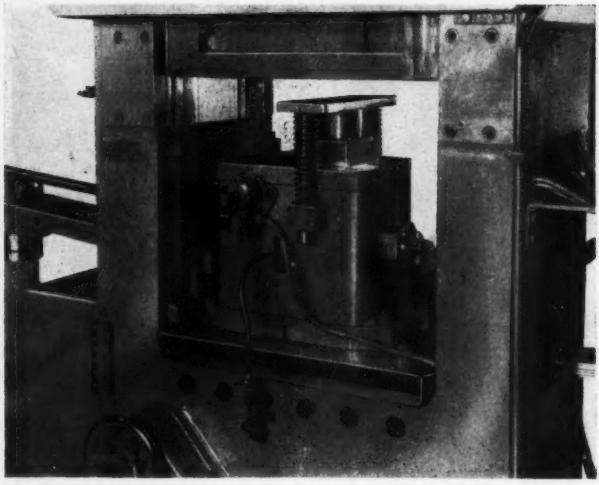


Fig. 2. Close-up view of the tool on the Colforg cropping machine

in Fig. 2. If required, a special tool can be provided which is designed for cropping and pre-forming slugs at the same cycle. Since the force required for pre-forming slugs is considerably greater than that for cropping, this tool is used for slugs of smaller diameters than those normally produced on the machine by cropping only.

Following the cropping operation, the blank is discharged on to the conveyor to be passed to the pre-forming machine. This machine incorporates an upper platen mounted on four cylindrical columns, and pre-forming is carried out by upward movement of the ram, to which pressure fluid is supplied by a separate floor-mounted pump unit. The delivery of pressure fluid to the ram, and consequently the operating cycle of the pre-forming machine, is controlled from the convevor, through an electro-magnetic clutch and solenoid valves. Pre-forming may be carried out between flat die surfaces or between dies that are profiled to suit the workpiece to be produced at the cold forging stage.

From the pre-forming machine, the slugs are passed by the same conveyor to the upper end of an inclined chute on the chamfering machine, down which they slide to be traversed between a central cutter of inverted cone shape, as seen at *A* in the close-up view Fig. 3, and a number of rollers, as at *B*. This machine provides for removing burrs resulting from the cropping operation and for chamfering the slugs at one end to facilitate loading into the forging die. During the chamfering operation, the slugs are simultaneously rotated and traversed on a circular path by an eccentrically-mounted disc which is located beneath the cutter and is driven in the opposite direction. Contact pressure between the slugs and the driving disc is maintained by a spring-loaded steel cable which surrounds the rollers. This arrangement enables a chamfer to be cut on a slug which may be slightly non-circular in plan shape. The motor-driven cutter can be adjusted in a vertical direction by means of a handwheel to provide for chamfering slugs of different diameters within the capacity of the machine. When chamfering has been completed,

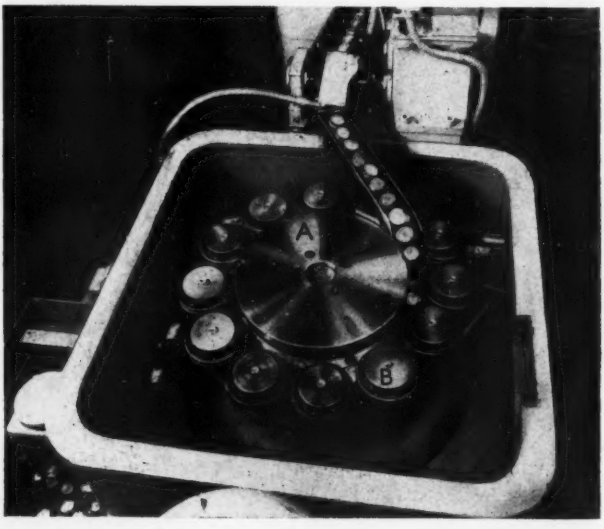


Fig. 3. For removing burrs resulting from cropping, and chamfering, the slugs are traversed between the inverted cone-shaped cutter *A* and rollers, as at *B*, by a rotating, eccentrically-mounted disc

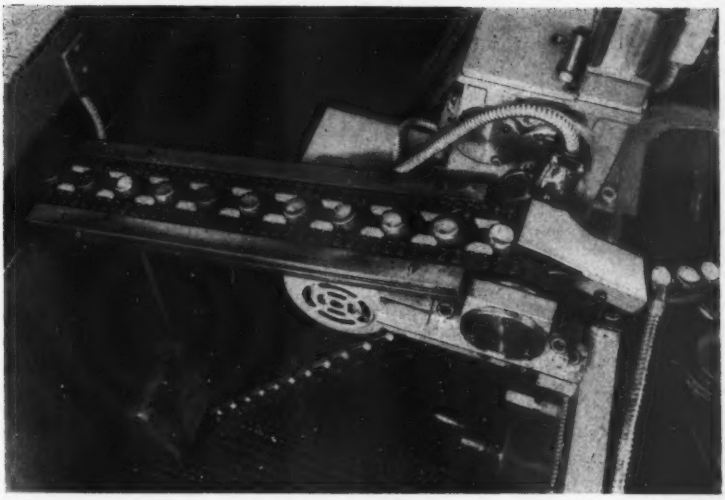


Fig. 4. Close-up view of part of the conveyor for automatically transferring slugs from one machine to the next in the installation shown in Fig. 1

the slugs are discharged from the machine by way of a chute seen at the left-hand side of the bed in Fig. 3.

In the close-up view Fig. 4, a number of slugs may be seen on the conveyor for transfer between the pre-forming machine and the chamfering machine. The conveyor passes between the platen and the bed of the pre-forming machine, and through openings in the bed of this machine and the cropping machine, and comprises, essentially, two motor-driven roller chains which can be adjusted towards and away from each other to suit the diameter of the slugs to be handled. The inner edges of the chains carry blocks which are positioned opposite each other, and serve as pushers for moving the slugs from one machine to the other in the line.

The entire installation is controlled by switches incorporated in a separate floor-mounted unit, and a comprehensive system of interlocks is provided.

New Arms for Square D Switches

For use on limit switches in their Class 9007 type AW range, Square D, Ltd., Cheney Manor, Swindon, Wilts., have recently introduced a roller-type operating arm, the effective length of which may be adjusted from 1 to 4 in., with reference to a graduated scale.

A Square D limit switch is here seen equipped with a new operating arm, which may be adjusted through 360 deg. by means of a micrometer-type system

A second design of arm, which is available and is seen mounted on a switch in the accompanying illustration, is provided in various lengths from ¾ to 3 in., and can be adjusted angularly through 360 deg. by means of a knurled knob. Turning this knob through a complete revolution moves the arm through an angle of 20 deg., and corresponding graduations are marked on the periphery of the shaft that carries the arm assembly. A radial line is marked on the knob, and facilitates setting the arm between adjacent divisions.

The company have also added to their range an oil-tight selector switch, designated Class 9001 type TS, which is provided with an operating knob that can be readily actuated by a person wearing gloves.

Some Design Characteristics of the Internal Gear Pair

By A. FISHER, F.I.M., A.M.I.Mech.E.

IT IS GENERALLY ACKNOWLEGED by gear designers and power transmission engineers that the inherent load-carrying capacity of internal gear teeth is much higher than that of external gears of corresponding size. This advantageous feature results from the tooth geometry, the relative radius of curvature of the contacting teeth—on which the load capacity largely depends—being greater in internal gearing by virtue of the "enwrapping" or "enveloping" effect of the concave profiles. The magnitude of the potential increase in load capacity, as indicated by the relative radius of curvature, can be considerable, particularly in gear pairs with only small differences in tooth numbers, such as are used in some types of high-ratio epicyclic gears.

A second valuable feature associated with internal gearing is the compactness of assembly which results from reduced shaft centre distances. In internal gearing, the shaft centre distance is given not by the sum but by the difference of pitch circle radii, and, here again, the accompanying advantages can be considerable since, in addition to the saving in floor space, both gear casing and bedplate sizes and weights may be much reduced as compared with those required for transmissions incorporating external gears.

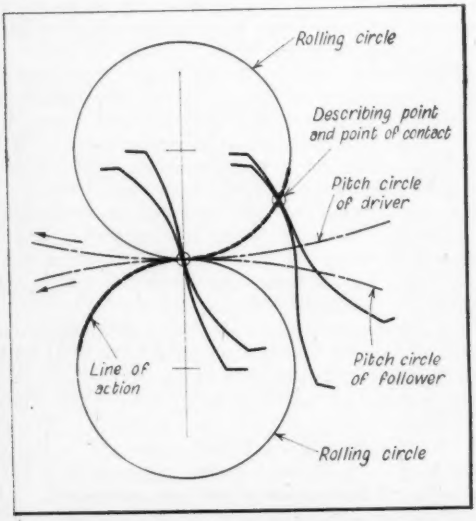


Fig. 1. Diagram showing the elements of cycloidal profile generation

Apart from these considerations, a comparison of sliding relationships under normal tooth contact conditions discloses a substantial difference in the total amount of sliding in favour of internal gearing, which may be expected to be reflected in reduced frictional losses and consequently increase in efficiency. The amount of sliding between gear teeth is, of course, proportional to the relative angular velocity, which in external gears is the sum of, but in internal gears is the difference between, the angular velocities of gear and pinion.

Since all these beneficial factors may operate simultaneously, it is rather surprising, on the whole, that internal gearing is so infrequently used. There are admittedly one or two other factors which may to some extent offset the favourable points mentioned above, for example, internal gears are rather more difficult—and therefore more costly—to produce, and bearing arrangements may in some cases be rather more complicated. However, these drawbacks are probably of minor importance compared with the resultant gains, and the responsibility for the apparent neglect must be ascribed, at least partly, to reasons other than those concerned with production difficulties and economics of manufacture.

The type of gear to be used in any particular application is usually decided by the design-draughtsman, who, while generally quite confident of his ability to design external gears satisfactorily, is often less sure about internal gears and therefore possibly tends to avoid using them in transmission arrangements. This reluctance is understandable, for there are occasional limitations and even pitfalls in the use of internal and epicyclic gears which are not met with in orthodox external gearing. It is not so obvious why experienced and reputable gear-making firms so rarely recommend internal and epicyclic gears and do not normally have standard designs in which these difficulties have been effectively dealt with.

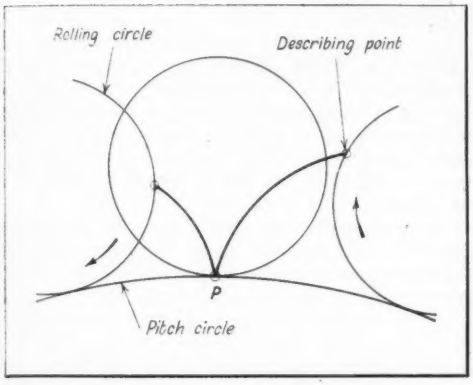


Fig. 2. Diagram showing the generation of a cycloidal cusp

In the highly competitive conditions of today one would expect to see the potentialities of these types of gear reasonably fully exploited while retaining the superior production facilities associated so firmly with the standard involute forms of teeth. However, in the search for means of increasing load-carrying capacity a good deal of interest is being shown at the present time in other tooth forms and it might be useful for workers in this field to note that when certain conditions are observed, and over a certain range of tooth number combinations, the almost forgotten cycloidal tooth form possesses the potentially valuable property of "double contact." Under the particular conditions described below, two separate points of contact can occur on the one mating pair of tooth profiles, and where advantage can be taken of adequate face width, helical teeth and overlap, an area of almost "surface" contact can be obtained (on solid gears) between these points.

This phenomenon should be of interest to those investigators engaged in research on, for example, the "Novikov" type of gear, which has been credited with somewhat similar properties.

THE CYCLOIDAL INTERNAL GEAR

In cycloidal gearing of both external and internal types, the contacting tooth profiles are generated by means of rolling circles which are in contact with the pitch circles at the pitch point, and roll at the same circumferential velocity as those circles. The point of contact between the mating tooth profiles therefore coincides with the common describing point lying on the rolling circle, the line of action being in consequence a part of the rolling circle. Fig. 1 shows the elements of the profile generating process.

In external gears of the cycloidal type, the describing point on the circle rolling outside the pitch circle generates a cusped epicycloid on passing the pitch point, as shown in Fig. 2, and, similarly, that on the circle rolling inside the pitch circle generates a cusped hypocycloid. In each case, only one branch of the cusp is available as a practical tooth profile at any one moment, exactly as in the involute system. The other branch exists idly in space, as does the unused branch of the involute cusp.

Since in any one gear both the epicycloid and hypocycloid can (each) be described by two rolling circles, of diameters differing in size by an amount equal to the diameter of the pitch circle, as shown for an epicyloid in Fig. 3, it follows that in combination there can be two lines of action which can be intersected simultaneously by an appropriately positioned tooth profile and therefore there are two potential points of contact on the one tooth profile. In Fig. 4, the potential contact points for the position of the profile shown are at *A* and *B* on the addendum and dedendum respectively. The two rolling circles for each curve may be conveniently termed "primary" and "secondary," the primary being the smaller in each case.

In solid external cycloidal gears, as distinct from the purely geometrical construction, only one of the possible contact points on a given tooth profile can be utilized at any one instant. The other will be a point of contact between a useful

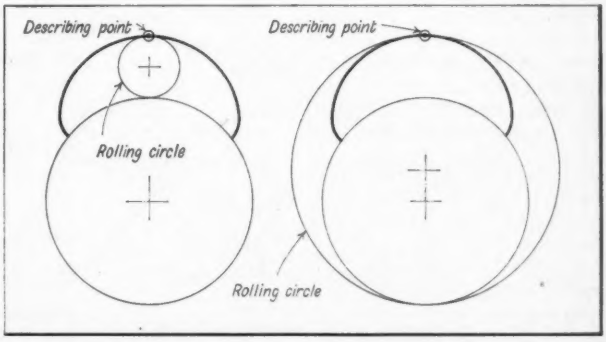


Fig. 3. Generation of an identical epicycloid by different rolling circles

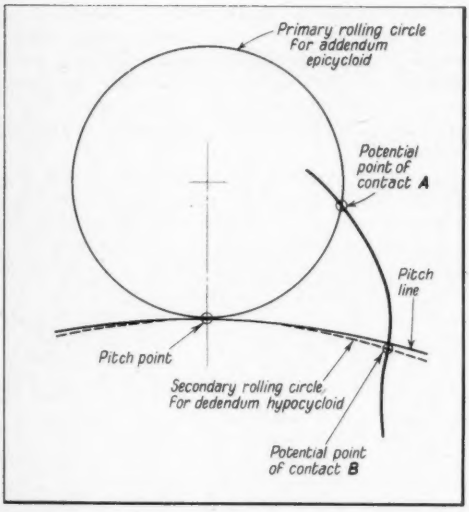


Fig. 4. Potential simultaneous contact points on a cycloidal tooth

branch on one gear and the unwanted and unused branch of the cusp on the mating gear (this branch existing only as a geometrical abstraction). In comparison, the mating profiles at the two contact points in internal cycloidal gearing—on recess but not on approach contact—are both parts of the usefully positioned branches and therefore useful double contact is possible, provided that interference is avoided by making the diameter of the primary rolling circle equal to half the difference in the diameters of the two pitch circles. If this condition is observed, a point on the secondary rolling circle will generate simultaneously the epicycloid of the pinion tooth and the hypocycloid of the wheel tooth—thus eliminating odontoidal interference—at the same time as a point on the primary rolling circle is generating the same two curves at a different position. This simultaneous generation at two different points on the mating tooth profiles constitutes double contact.

Fig. 5 shows mating profiles in seven successive positions for a gear combination of ratio 1·5 to 1, designed on the above principles, and it will be seen that during recess at position (5) the profiles are in contact at two points *A* and *B*, where intersection occurs with the two rolling circles concerned. *DPAE* is the line of action, and *PBCF* is the secondary line of contact.

At position (6) the contact point at the higher pressure angle position has moved away from the pinion tooth, the profile having passed out of the primary rolling circle region, but the lower pressure angle or secondary contact point is still operative and will remain so until the pinion addendum circle intersects the secondary line of action, i.e., the secondary rolling circle. It will be noted that secondary contact takes place under a condition of negative pressure angle, so that the average angle is reduced. How useful such secondary contact might be can be determined only by experiment. Obviously, the extended contact must to some degree affect the low friction loss which was counted an advantage in the ordinary internal gear pair.

In simple internal cycloidal gear pairs, the previously mentioned essential relationship between diameters of rolling circles and pitch circles severely limits the range of tooth number combinations with which double contact can be achieved, but the restriction is of less importance in epicyclic gears of compound types, where high ratios can be obtained by using gears with only a small difference in tooth numbers.

Disengagement interference is generally less

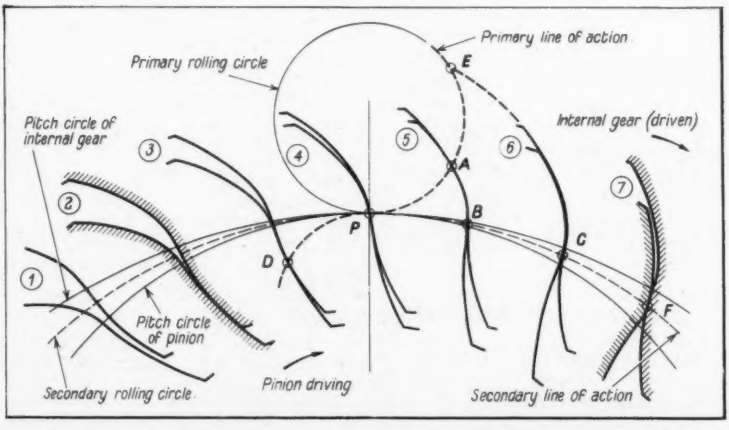


Fig. 5. Diagram illustrating double contact with a cycloidal internal gear pair

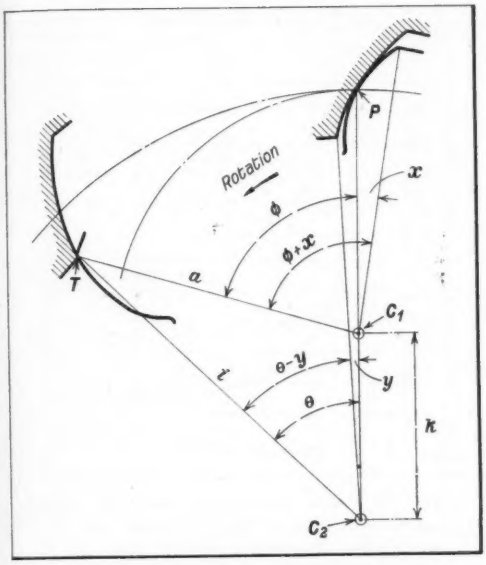


Fig. 6. Diagram illustrating disengagement interference in involute internal gears

troublesome in cycloidal internal gear pairs than in involute internal gears because of the relatively higher pressure angle at the tips of the teeth and consequently reduced width on the addendum circle. Where secondary contact exists under the above conditions, disengagement interference is avoided, since such legitimate contact continues until the addendum circle crosses the secondary line of action. It is desirable to emphasize again, however, that the primary rolling circle diameter must be made equal to the difference in pitch circle radii.

In this type of gear, with the pinion driving under conditions of double contact, the efficiency of lubrication may be somewhat different from that obtained when the gear drives, since in the latter case, on approach contact, some oil may be trapped in the space between the profiles, and may tend to produce a condition of forced lubrication. It should be interesting to determine the effects of these conditions at different speeds, by making comparative tests under load.

This feature of double contact in internal gears with cycloidal teeth is not, of course, a new discovery, having been known for about a century, but it does not appear to have been utilized much, if at all. It is, however, a significant and suggestive phenomenon, and if more widely appreciated would no doubt greatly stimulate the search for tooth profile systems providing double contact but involving profiles easier to generate than those of cycloidal type.

THE INVOLUTE INTERNAL GEAR

The involute internal gear does not possess the feature of double contact but, as is well known, has compensating advantages in the field of production. The gain in load capacity associated with high relative radius of curvature of profile, which it shares to some extent with cycloidal gears, has already been mentioned. Perhaps the main disadvantage is the possibility of disengagement interference when the difference in tooth numbers is small, which necessitates tedious calculations to check whether this interference will occur in any given gear pair. These calculations can be shortened considerably by standardizing methods and by using tables which, once calculated, become available for all pressure angles and tooth number combinations. It is then possible to plot a few calculated results in curve form and derive a formula which will enable the interference check for any pressure angle to be carried out in a few seconds. The following description explains the procedure followed by the writer.

Fig. 6 illustrates the conditions when disengagement interference exists in involute internal gear pairs with teeth having uncorrected or unmodified addenda proportions. In this diagram, P is the pitch point, and C_1 and C_2 are the centres of pinion and gear respectively. For interference to be avoided at disengagement it is necessary that the pinion tooth profile, which has been in contact with the mating gear tooth profile at the pitch point, shall not overtake or overlap the gear tooth profile at any point before the addendum circle of the pinion crosses the addendum circle of the gear at the point T. That is, the angular rotation of the pinion between these two positions, which is the sum of the angles ϕ and x, must not exceed R times the simultaneous angular rotation of the gear, which is the difference betwen the angles θ and y, R being the gear ratio. These rotation angles are calculated as follows:—

Let ψ = Pressure angle at pitch point
α = Pressure angle at pinion tooth tip
γ = Pressure angle at wheel tooth tip
k = Centre distance
a = Addendum circle radius of pinion
i = Addendum circle radius of internal gear

angle x = (inv. α − inv. ψ)
angle y = (inv. ψ − inv. γ)
Then $\cos\theta = (i^2 + k^2 - a^2)/2\,ik$

$$\cos \phi = (i^2 - k^2 - a^2)/2ak$$

and $(\phi + x) \gtrless R(\theta - y)$ ..... (1)

When making calculations of this nature it is always preferable to construct tables for all parameter values over the ranges likely to be used. For example, a table of addendum circle pressure angles for external and internal gears will enable values required during the calculation to be read off directly. The completion of such a table in one spell will occupy much less time than the total required for interrupted calculations of even a fraction of the number of separate values. The accompanying table gives such values for the standard pressure angle of $\psi = 20$ deg. Similar tables for any other pressure angle may be calculated from the formulae below:—

$\cos \alpha = [T/(T + 2)] \times \cos \psi$ ..... (2)

$\cos \gamma = [T/(T - 2)] \times \cos \psi$ ..... (3)

where T is the number of teeth in the gear concerned.

Again, tables of (inv. α – inv. ψ) and (inv. ψ – inv. γ) will be found invaluable, not only for calculation of interference limits, but for all backlash and tooth thickness calculations, since the values required in almost all cases are the differences of involute functions, and not the functions themselves. The writer uses tables of (inv. α – inv. 20) and (inv. 20 deg. – inv. γ) calculated for all values between 0 deg. and 38 deg., for each minute of angle, to seven decimal places.

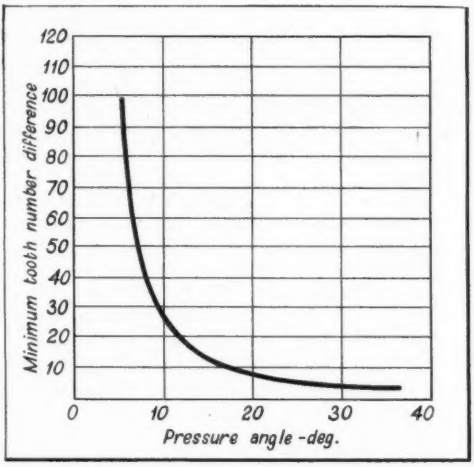


Fig. 7. Curve showing the minimum tooth number differences to ensure freedom from disengagement interference by the teeth of an internal pair

Using these methods, interference limits for different pressure angles and tooth number combinations have been calculated and the results plotted as shown in Fig. 7. The formula derived to suit the curve obtained gives N, the tooth number difference for wheel and pinion, of any practicable pressure angle, at which disengagement interference starts as follows:—

$N = [170/(\psi - 4)] - 2{\cdot}3$ ..... (4)

where ψ is the pressure angle of the particular system being used.

This formula gives satisfactory results for all pressure angles between 6 deg. and 36 deg., for gears with teeth of uncorrected addenda. Pressure angles below 6 deg. are not practicable for internal gears with uncorrected addenda, because the number of teeth required to avoid odontoidal interference then becomes

PRESSURE ANGLES AT TIPS OF TEETH ON EXTERNAL (α) AND INTERNAL (γ) GEARS, OF 20-DEG. PITCH LINE PRESSURE ANGLE (UNCORRECTED)

T	α	γ	T	α	γ	T	α	γ	T	α	γ
6	45° 11′		47	25° 40′	11° 3′	88	23° 15′	15° 57′	129	22° 17′	17° 21′
7	43 2		48	25 34	11 19	89	23 13	16 0	130	22 16	17 22
8	41 15		49	25 28	11 34	90	23 11	16 3	131	22 15	17 24
9	39 45		50	25 22	11 48	91	23 9	16 6	132	22 14	17 25
10	38 27		51	25 17	12 2	92	23 7	16 9	133	22 13	17 27
11	37 20		52	25 12	12 14	93	23 5	16 11	134	22 12	17 28
12	36 21		53	25 6	12 26	94	23 4	16 14	135	22 11	17 29
13	35 28		54	25 1	12 37	95	23 2	16 17	136	22 10	17 30
14	34 41		55	24 56	12 48	96	23 0	16 19	137	22 9	17 31
15	33 59		56	24 52	12 58	97	22 58	16 22	138	22 8	17 32
16	33 21		57	24 47	13 8	98	22 57	16 25	139	22 8	17 34
17	32 47		58	24 43	13 17	99	22 55	16 27	140	22 7	17 35
18	32 15		59	24 39	13 26	100	22 53	16 29	141	22 6	17 36
19	31 46		60	24 35	13 34	101	22 52	16 32	142	22 5	17 37
20	31 19		61	24 31	13 42	102	22 50	16 34	143	22 4	17 38
21	30 55		62	24 27	13 50	103	22 49	16 37	144	22 3	17 39
22	30 32		63	24 23	13 57	104	22 47	16 39	145	22 2	17 40
23	30 10		64	24 20	14 4	105	22 46	16 41	146	22 2	17 41
24	29 50		65	24 16	14 11	106	22 44	16 43	147	22 1	17 42
25	29 32		66	24 13	14 18	107	22 43	16 45	148	22 0	17 43
26	29 15		67	24 9	14 24	108	22 42	16 47	149	22 0	17 44
27	28 58		68	24 6	14 30	109	22 40	16 49	150	21 59	17 45
28	28 43		69	24 3	14 36	110	22 39	16 51	151	21 58	17 46
29	28 28		70	24 0	14 41	111	22 37	16 53	152	21 57	17 47
30	28 14		71	23 57	14 47	112	22 36	16 54	153	21 57	17 48
31	28 1		72	23 54	14 52	113	22 35	16 56	154	21 56	17 49
32	27 49		73	23 51	14 57	114	22 34	16 58	155	21 55	17 50
33	27 38	0° 0′	74	23 48	15 2	115	22 33	17 0	156	21 54	17 51
34	27 27	3 13	75	23 45	15 7	116	22 31	17 2	157	21 54	17 52
35	27 16	4 42	76	23 43	15 11	117	22 30	17 4	158	21 53	17 53
36	27 6	5 45	77	23 40	15 16	118	22 29	17 5	159	21 53	17 54
37	26 56	6 35	78	23 38	15 20	119	22 28	17 7	160	21 52	17 54
38	26 47	7 18	79	23 35	15 24	120	22 26	17 8	161	21 51	17 55
39	26 38	7 55	80	23 33	15 28	121	22 25	17 10	162	21 51	17 56
40	26 30	8 27	81	23 30	15 32	122	22 24	17 11	163	21 50	17 57
41	26 22	8 56	82	23 28	15 36	123	22 23	17 13	164	21 50	17 58
42	26 14	9 22	83	23 26	15 40	124	22 22	17 14	165	21 49	17 58
43	26 7	9 45	84	23 23	15 43	125	22 21	17 16	166	21 48	17 59
44	26 0	10 7	85	23 21	15 47	126	22 20	17 17	167	21 48	18 0
45	25 53	10 27	86	23 19	15 50	127	22 19	17 19	168	21 47	18 0
46	25 46	10 46	87	23 17	15 53	128	22 18	17 20	169	21 46	18 1

inordinately great.

Fig. 9 shows the disengagement condition in an involute internal gear pair of 16 and 13 teeth, of 36 deg. pressure angle —a limiting combination.

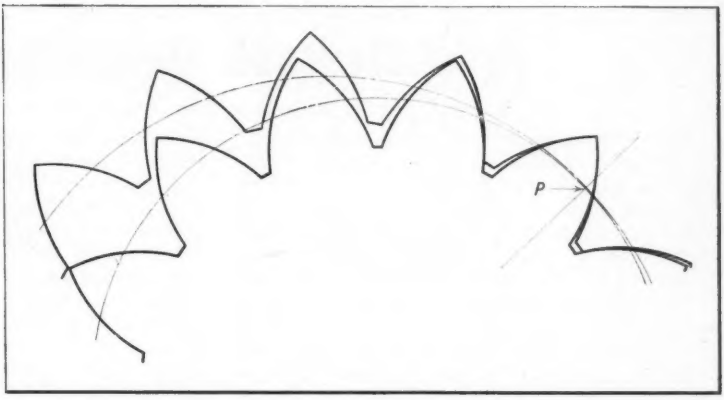


Fig. 9. Disengagement condition for an involute internal gear pair with 16 and 13 teeth of 36-deg. pressure angle

RELATIVE RADIUS OF CURVATURE OF INVOLUTE INTERNAL GEARS

The relative radius of curvature "R_r" for involute internal gears is given by the reciprocal of the relative curvature, taking the sign of the curvature into account, thus:—

$$R_r = 1/(1/R_1 - 1/R_2)$$
$$= 1/[(R_2 - R_1)/R_2R_1)] = R_2R_1/(R_2 - R_1)$$

where R_2 = Radius of gear profile
R_1 = Radius of pinion profile

In Fig. 8 the relative radius of curvature is taken with contact at the pitch point, giving the relationship

$$R_r = R_1 (R_1 + C \sin \psi)/(R_1 + C \sin \psi - R_1)$$
$$i.e., R_r = R_1 (R_1 + C \sin \psi)/C \sin \psi \quad \ldots\ldots\ldots (5)$$

This formula (5) differs from that sometimes given, viz., $R_r = R_1 (C \sin \psi - R_1)/C \sin \psi$.

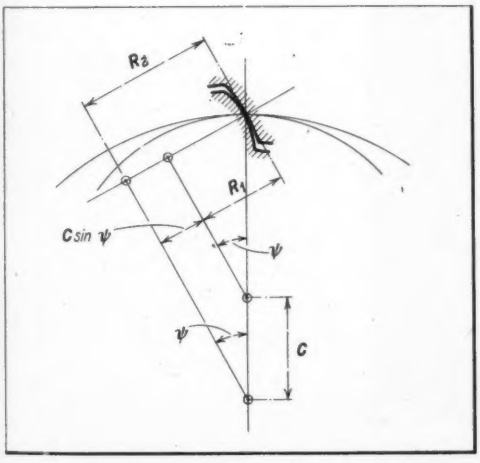


Fig. 8. Diagram showing the radii of curvature of involute internal teeth

Actually, this latter formula is concerned with the relative radius of curvature of external gears.

The accuracy of formula (5) above can be checked by using the ratio $(D + d)/(D - d)$, which is the ratio of R_r, for internal gears to R_r, for external gears.

It will be clear that when the difference in diameters of the two mating gears is small, the increase in relative radius of curvature can be very great. The combination shown in Fig. 9 provides a striking example of this effect, separation of tooth curves at positions near the pitch point being difficult to discern.

SPECIAL BALL BEARINGS FOR GYROSCOPES.—E.M.O. Instrumentation, Ltd., Western Road, Bracknell, Berks., are now able to offer, in prototype quantities, special ball bearings made by the Barden Corporation, 31 East Franklin Street, Danbury, Conn., U.S.A., with whom they are associated. These bearings have been produced to meet the requirements for inertial guidance gyroscopes incorporated in guided missiles, and it is stated that 14 dimensions of each bearing are held to a tolerance of 20 micro-inches.

Special production and gauging techniques have been developed to enable these limits to be maintained. All inner and outer rings are numbered serially, as are the completed bearings. When despatched, each bearing is accompanied by an inspection sheet and traces from electric recording gauges, which show the dimensions of the inner and outer rings. Particular attention is paid to surface finish.

Productograph Demonstration

The Productograph system for indicating and recording comprehensive data relating to individual stages in a production sequence was demonstrated recently by Adrema, Ltd., Telford Way, London, W.3, who have acquired the marketing and assembly rights in this country from the German firm of Siemens-Halske. This system is applicable to an extensive variety of production processes and manufacturing units, including machine tools, power presses and die casting machines, for example. Information is derived from transducers on the individual machines whereby electrical signals are generated which are fed by cables to the central Productograph control station. A transducer may take the form of a micro-switch, proximity switch, or other impulse generating unit, and the control station can be arranged to handle signals from 20 to 200 transducers.

On each machine linked to the Productograph installation there is a small panel with a signal lamp and a group of push-buttons of different colours. A time delay associated with the transducer is so arranged that if no signal is received over a period that is approximately equal to 50 per cent more than the machine floor-to-floor cycle time, the signal lamp on the panel is illuminated. The machine operator then depresses one of the push-buttons to indicate the reason for the delay in production to the control station of the Productograph system, in accordance with a code. For example, one push-button may indicate tool failure, another, awaiting raw material, and another, machine breakdown. If necessary, the machine operator can communicate with the control supervisor by means of a microphone-loudspeaker unit on the panel.

A typical control station is seen in the accompanying illustration, and it provides for handling signals from 20 machine tools at the Adrema works. At this station, the equipment includes a linear counter to provide a visual indication of the output of each machine to which the system is applied. This linear counter may be seen in the illustration at the extreme left of the control supervisor, who is seated at the main console. The counter has 20 linear scales, each divided into 30 large graduations, and each of the latter is sub-divided into ten smaller units. Two movable transparent strips are superimposed on each scale, and are adjustable. A yellow strip, at the right, is pre-set to indicate the required total output, and a blue strip, at the left, is advanced automatically to indicate the actual output at any given time. If the target figure is exceeded, the excess output is shown in green, as a result of the superimposition of the blue and yellow strips. At the end of each scale there is a decade plug, whereby the blue strip can be arranged to move one division for every one, ten, one hundred, or one thousand signals received from the associated machine.

The console of the Productograph control system installed in the works of Adrema, Ltd., London, who hold the selling and assembly rights in this country

The control supervisor can always see at a glance, from the linear counter, the cumulative output from each machine, and the actual number of parts produced is shown on a digital counter in a bank at the side of the linear counter. A second bank of counters serves to indicate the total non-productive time for each machine. Between the linear counter and the banks of digital counters there are

signal lamps which are lit when a machine is non-productive.

As may be seen, the main console forms a desk, at the rear of which there is a panel with a bank of six electrical counters to indicate the total idle time for all the machines for each of six different causes. Next to these counters there is a group of signal lamps to indicate, instantaneously, which machines have stopped and for what reasons. The panel also incorporates a loudspeaker unit for communication with each machine, and the associated microphone is mounted on a flexible tubular arm at the side of the console. This equipment can also be used to communicate with administrative staff, and with other departments of the factory, such as stores and maintenance sections.

At the right of the console is a graphical recording unit, for which a special waxed paper is fed continuously from a roll at a slow speed. As the paper is traversed, two stylus-points are actuated by the signals received from each machine, to produce a permanent record of the productive cycles, and the non-productive time. Productive cycles are indicated by a series of vertical strokes, that form a shaded line on the paper, and any breaks are readily apparent. When a break occurs, marks are made parallel with the productive signals, but slightly below them, and these marks differ in accordance with a code, to indicate the cause of the interruption, as transmitted to the control station by the operator.

When the productive cycles are of short duration, the vertical strokes are very closely spaced, and may, in consequence, be difficult to analyse. If required, a supplementary chart can be produced for any single machine, on a narrow waxed-paper strip which moves at ten times the speed of the main chart. The signals on this supplementary chart are widely spaced and readily observed, and both charts can subsequently be studied and the causes of the interruptions analysed.

A tape recorder is built into the console and provides for making a permanent record of any messages received from the machine operators. This unit is particularly useful when a night-shift is in operation, and a control supervisor may not be on duty.

At the demonstration, it was stated that two hundred Productograph installations were in operation in Germany, and that it had been found that only 8 per cent of interruptions in production were due to the machine operator, the remainder being attributable to other causes, such as faulty drawings, bad material, machine break-downs, or tool breakages. The German applications cover a variety of factories, concerned, for example, with general engineering, electronics and plastics, and the Adrema installation is the first for a general machine shop.

Equipment is supplied on a rental basis for a minimum period of three years, and the installation time for a 20-machine unit, including provision of the low-voltage wiring between machines and console, is one week.

Letters to the Editor

[*The Editor does not hold himself responsible for the views expressed by his correspondents.*]

Advantages of Unit Tooling Systems

[To the Editor of MACHINERY]

SIR,—In your editorial on the above subject (in MACHINERY, 99/119—19/7/61), you remark (paragraph 3) that "These systems have already found wide application, although it appears that they are not yet being employed on anything like the scale which would be justified by the advantages that they offer."

This observation could equally well be made about several other new techniques currently available for use in connection with pattern, jig and fixture work, and, in particular, about our own efforts in the field of plastics tooling.

The standard units to which you referred are easily assembled or incorporated in epoxy compound materials, and a good example was illustrated by you as long ago as August, 1958. We wonder, therefore, why more extensive use is not made of these time and money saving methods, particularly when the ease of modification is taken into account.

In the same way that standard units are available, we have a range of standard plastics tooling compounds which are being extensively used with these components—also independently—but concerning the merits of which industry seems to require an inordinate amount of convincing.

This kind of resistance to new thinking is, unfortunately, only too prevalent but will have to be overcome if we are to face—as seems very likely—increasing competition in overseas markets.

Many products must be made in short runs for proving or to satisfy particular requirements. For such purposes, the cost of conventional tooling is often prohibitive. The use of standard units and Toolform plastics can do much to reduce production costs in such circumstances.

The Kenilworth Manufacturing Co., Ltd.,
L. H. LeVay,
Managing Director.

West Drayton

Developments at Bromford Iron & Steel Works

An important stage in the expansion programme of the Bromford Iron & Steel Co., Ltd., Bromford Lane, West Bromwich, Staffs., was reached recently when the Rt. Hon. Frederick J. Erroll, M.I.E.E., A.M.I.Mech.E., M.P., Minister of State, Board of Trade, officially opened the new factory for the production of welded mesh reinforcement and started a new cold rolling mill for steel strip. The new building, erected on a site adjacent to the rolling mill bays, has an area of 15,000 sq. ft. and houses a wire mesh welding installation supplied by Entwicklung und Verwertung Gesellschaft, Graz, Austria, and a wire drawing plant. There is also a stacking area for wire coils and finished welded mesh, a loading bay and office accommodation.

Hot rolled rod is drawn through tungsten-carbide dies into wire of various diameters, ranging from 0·400 in. (4/0 s.w.g.) to 0·080 in. (14 s.w.g.), at speeds of 400, 600, or 800 ft. per min., and coiled on a gravity block built by Sir James Farmer Norton & Co., Ltd., Salford, Lancs. Coils of wire, each of one ton weight, are loaded on to turntables on the shop floor in front of the welding machine and the free ends are fed through guides and straightening rolls to the adjustable water-cooled welding heads which are attached to a movable beam. In operation the beam rises and falls, and at each stroke the longitudinal wires are drawn from the coils and fed between the upper and lower welding electrodes in pre-set steps which may range from 1 to 16 in., but are usually 3 in. or 6 in. to conform to B.S. 1221 for reinforcing fabric, the settings being steplessly-variable over the full range of adjustment.

Cross wires, previously cut to length and stacked in a magazine, are dropped singly by feed fingers, during the upward stroke of the beam, to fall at right angles on to the array of longitudinal wires. Welding at the cross joints of the wires takes place on the downward stroke of the beam. After each welding sequence the mesh fabric is pulled forward automatically, and is fed to an hydraulic shear which may be pre-set to operate at specific intervals, to provide the lengths of cut fabric required. When the mesh fabric is required in continuous form, the shear blade is rendered inoperative, and the material is coiled at a further station, on a collapsible mandrel. Fig. 1 shows a general view of the installation from the delivery end.

The new non-reversing cold rolling mill built by W. H. A. Robertson & Co., Ltd., and shown in Fig. 2, is designed to produce steel strip to a high finish in widths of 8 in. to 20½ in. and thicknesses of 0·080 in. to 0·156 in. It has a maximum rolling speed of 400 ft. per minute, and the installation will produce coils of material up to 62 in. outside diameter, and weighing 5 cwt. per in. of strip width. Material is fed from a decoiling box through 5-in. diameter pinch rolls and a straightening roll to the reducing rolls. The strip is continuously gauged by a "flying micrometer" as it leaves the reducing rolls and the reading is displayed on a meter provided with scale markings showing

Fig. 1. Installation at the works of Bromford Iron & Steel Co., Ltd., for the production of welded mesh fabric for concrete reinforcement and other applications

permissible tolerances, and the operator is thus enabled to correct the roll settings during running, if necessary. Rolled strip is coiled on an expanding mandrel and at the end of a run is freed, raised to floor level by built-in lifting equipment, and pushed forward to be secured.

In view of the increased output of rolled strip that has resulted from the installation of the new mill it has been found necessary to augment the heat treatment facilities in the works by the addition of four Birlec inert atmosphere bell-type furnaces each of which will take a 25-ton charge. It is anticipated that the combined output of the cold rolling mills in the works will soon exceed 5,000 tons per month and that much of the production will be available to meet export orders.

Fig. 2. A view of the new, 4-high non-reversing cold rolling mill which was supplied by W. H. A. Robertson & Co., Ltd.

The area in which the Bromford works are situated has been connected with iron and steel manufacture for more than a century. Early records show that 60 puddling furnaces were in operation on the site by 1868 and that soon afterwards seven rolling mills were installed. At the beginning of this century the works were expanded and a 6-stand strip mill, driven by a 1,100-h.p. steam engine, was installed. The works were acquired by the present owners in 1958.

Trade Publications

PLANNED PRODUCTS (METALLURGY), LTD., Reliant Works, Betchworth, Surrey. Leaflet describing the Metallurgical Services unit for assessing the hardenability of steels and non-ferrous alloys by the end quench technique.

IMPERIAL CHEMICAL INDUSTRIES, LTD., P.O. Box 216, Birmingham, 6. Brochure entitled "Titanium for Textile and Paper Pulp Bleaching" in which the various applications of the metal in this field are discussed. There are numerous illustrations showing some of the many components for which I.C.I. titanium is recommended.

CRAIG PUMPS, LTD., Barnfield Road, Giffnock, Glasgow. Folder describing the company's ceramic lined diaphragm pumps which are available in hand operated and motor driven types for a wide variety of applications connected, for example, with metal pickling, boiler descaling, electroplating, and surface treatment. Another publication is devoted to Craig ceramic lined centrifugal pumps for corrosive or abrasive liquors, or delicate liquors which must be kept free from metallic contamination.

LOW MOOR FINE STEELS, LTD., Low Moor, Bradford. Impressive loose-leaf catalogue covering the wide variety of extruded steel sections made by the company, issued for the benefit of design and development engineers. Some general remarks on such matters as condition and finish, lengths, thickness, and tolerance on cross section are given, and there is a useful pictorial index of 50 different sections. A separate page is then devoted to a dimensioned drawing of each section. Of the sections listed, 15 are of hollow type.

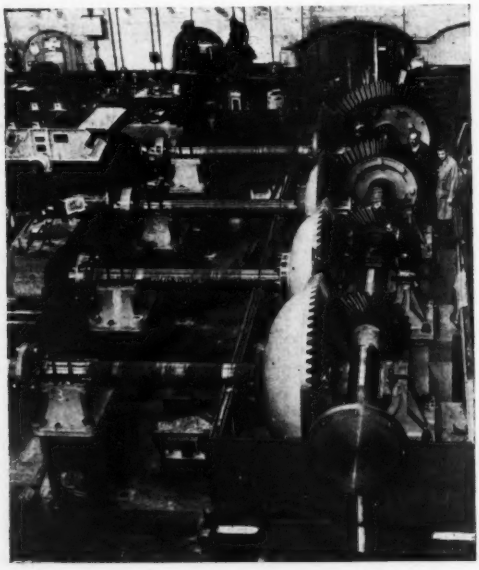
JOSEPH RHODES & SONS, LTD., Belle Vue, Wakefield. Brochures concerned with the following products: C-frame presses; fluid drive shears; hydraversal shears; and the stagger-feed press. The C-frame press brochure is particularly well illustrated by numerous half-tones and effective drawings in perspective, and the features of design are clearly described. These presses are built in geared and ungeared types and capacities range from 20 to 150 tons. Except for the two largest sizes, they are inclinable. The fluid drive shears are also described in considerable detail. They are built in A, B, and C series and the overall capacity range is from 14-gauge by 6 ft. to 1 in. by 16 ft. It is stated that on the automatic stagger-feed press, the average time required to change over for stampings of a different size is only 35 min.

NEWS OF THE INDUSTRY

Leeds and District

SAMUEL DENISON & SONS, LTD., Hunslet Foundry, Moor Road, inform us that they are experiencing a continued heavy demand for their range of weighing and testing machines and equipment which includes concrete cube and beam testing machines; tensile and universal testing machines ranging up to 50 tons capacity; high temperature creep and stress-rupture testing machines; and rope and chain testing machines of capacities up to 200 tons. Export trade is brisk, machines and equipment being at present on order for delivery to India, South Africa, Australia, Rumania, Canada and Sweden.

The company recently introduced a new hot tensile unit for testing specimens at elevated temperatures. This machine is available in both single and triple unit types, and we are informed that it has been very well received in industry. We understand that satisfactory results were obtained as a result of the company's participation in the Engineering, Marine, Welding, and Nuclear Energy Exhibition, and the range of machines and equipment is also to be shown at the forthcoming Industrial Exhibition at Manchester.



A quadruple drive gearbox unit for a new steel mill is here seen under construction in the works of Fairbairn, Lawson, Combe, Barbour, Ltd.

FAIRBAIRN, LAWSON, COMBE, BARBOUR, LTD., Wellington Street, are maintaining steady production in all departments. The activities include turning, boring and cutting helical and spur gears up to a maximum of 20-ft. diameter; production and assembly, under contract, of various types of machinery including machine tools; the manufacture of special gear drive units; and the construction of the company's range of shell moulding machines, also textile machinery and equipment. A large contract has recently been secured for the supply of hard-fibre textile machinery to Yugoslavia. A quadruple drive gearbox unit for a new steel mill is at present under construction in the works, and is shown partially assembled in the accompanying illustration. A similar gearbox unit, but for a double drive, was recently despatched.

ARMSTRONG (LEEDS), LTD., Burton Street, Dewsbury Road, report a brisk call for their range of surface finishing machines including flat lapping and honing machines and vertical honing machines ranging up to 60 in. stroke, also for hydraulic equipment and presses up to 500 tons capacity. Machines and equipment now in progress include a 36-in. capacity flat lapping and honing machine and special grinding machines which have been designed to meet customers' requirements.

The range of nozzle testing equipment made by the company is in good demand, and in particular a large volume of export orders is at present in hand.

HAYES ENGINEERS (LEEDS), LTD., Gelderd Road, inform us that their works are extremely busy with the production of their range of copy milling machines which includes the Diemaster, Tracemaster, and Hayes-Ferranti Tapemaster types. An exceptional demand is being experienced for

hydraulic copying units for fitting to existing machine tools in customers' works, also for building into new machine tools.

We are informed that a good trade is being developed in the design and construction of special machines incorporating hydraulic tracing devices. Machines of this type which have recently been despatched from the works have included one for machining turbine rotors from the solid, and another for milling flame paths in diesel cylinder heads.

CROSTHWAITE FURNACES & SCRIVEN MACHINE TOOLS, LTD., York Street Ironworks, report a heavy call for their range of wheel making machinery from the motor car and commercial vehicle industry, and a steady demand for their ingot and billet breaking machinery, plate rolling machines, and plate edge planers.

A number of 16-roll bar straightening machines is at present on order, and work in progress includes a 7-in. billet breaking and bar straightening machine and a hydraulically-operated plate stretching machine with a capacity of 12 ft. by 4 ft. by ⅜ in.

A Graffenstaden 4½-in. spindle boring machine with extended column traverse and equipped with a 10-ft. by 7-ft. rotary table has recently been installed in the works.

Wheel making machinery and allied equipment in production in the works includes a machine for producing wheels of 4 ft. diameter by 2 ft. wide; dressing machines; and a number of rim machines. A line for rim rolling which is under construction will comprise three machines with automatic transfer equipment, with an output capacity of 800 wheels per hour.

GREENWOOD & BATLEY, LTD., Albion Works, report a continuation of the heavy demand for their range of machines and equipment. Equipment in production includes 4-station type transfer cold heading machines; a number of hot forging machines; screw presses; thread rolling machines; high speed cold forging machines; cartridge case machinery; and a special cold heading machine for bottom bracket axles for bicycles. We are informed that an increasing call is being experienced for cold heading machines and equipment for a constantly extending range of applications.

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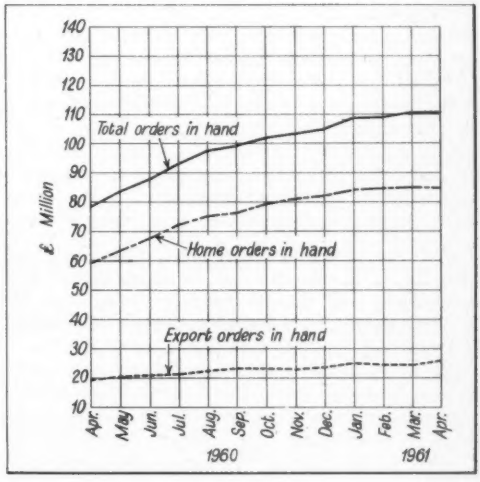
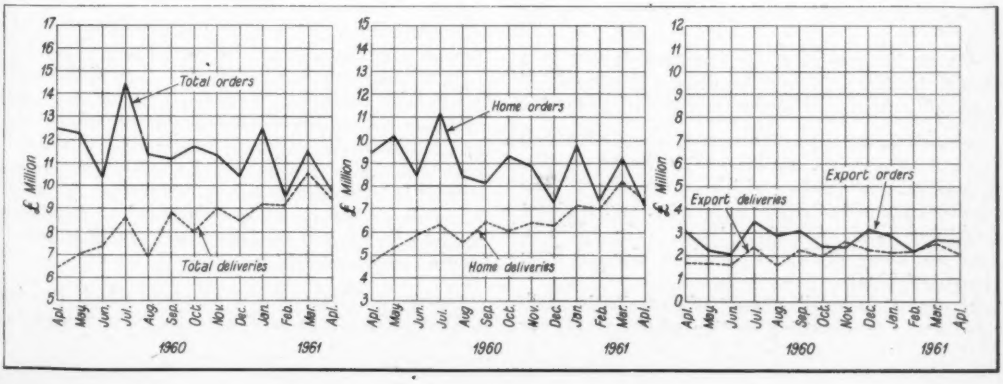




The accompanying graphs show the values of machine tool orders and deliveries for the period ending April 1961, also the values of orders in hand

HERBERT ALEXANDER & Co., LTD., Charmouth Street, report that their works are fully occupied on machinery for the production of semi-dry and refractory bricks. Approximately 50 per cent of the output is for companies within the group.

A new fabrication department has recently been built and a certain amount of re-organization is at present being carried out and new plant installed in the works.

MIDGLEY & SUTCLIFFE, LTD., Hillidge Works, Hunslet, inform us that their works are fully occupied with the production of their standard range of products which includes milling machines and radial drilling machines up to 6-ft. radius. The recent increase in the volume of orders is being well maintained, and the company is installing a number of new machine tools to enable output to be increased, including a Milnes heavy-duty fine boring machine.

CAMPBELLS & HUNTER, LTD., Sayner Road, Hunslet, are experiencing an increasing demand for gear cutting and contract machining. It may be noted that the services offered by the company to the engineering industries include sandblasting, case-hardening, heat treatment, and flame hardening by the Shorter process. Capacity is shortly to be increased by the installation of a number of new machine tools and equipment to which we hope to make further reference at a later date.

FUTURMILL CONVERSION, LTD., 6/8 The Headrow, Leeds, 1, who are now in occupation of their new offices and storage premises, inform us that the demand for their planer/miller conversion units is increasing rapidly, and that a large number of units is now in use in the heavy engineering industry. In addition, these units have been exported to various countries and the company is at present developing the export department to provide an efficient service for overseas customers. It is reported that a Futurmill unit recently installed for machining large steel slabs has enabled the time previously required to be reduced by about 75 per cent.

We are informed that the company is now in a position to offer a 24-hour service for the supply of Futurmill cutters and blades for use with the units.

NOEL PATON, LTD., Mabor Works, Whitehall Road, New Farnley, are busy with the production of special gear units, which are made to the requirements of individual customers, and contract machining work of various types. In addition, gears are being produced complete, also cut from customers' blanks.

At present, a small amount of capacity is available in the gear cutting section of the works for spur gears up to 30-in. diameter by 6-in. face width by 1¼-in. pitch.

SHAFTESBURY PRECISION SERVICES, LTD., Roundhay, report a steady call for their Reveal-O comparator gauge. A good volume of orders is in hand for the company's S.P.S. Mark V Mini-Bar boring unit which has a capacity for holes up to 3 $\frac{7}{16}$ in. diameter by 8-in. deep, and is easily transportable for machining operations on site.

A new office block extension is now under construction at the works and new plant recently installed in the machine shop includes a Dowding V.8 gear hobbing machine. Delivery of a Ward 7 DS capstan lathe is expected in the near future.

TOWLER BROTHERS (PATENTS), LTD., Electraulic Works, Rodley, are busy with the production of their wide range of high pressure, high speed hydraulic pumps, valves, and control gear. We are informed that various new designs are at present in the development stage.

R. SUTCLIFFE.

London and the South

LATYMER (G.T.) PRODUCTS, LTD., 142 Hammersmith Road, W.6, are producing Latymer semi-automatic blow moulding machines designed for fast-cycle operation and capable of producing blown containers and other shapes up to 40-oz. capacity. With single impression moulds, it is stated, small bottle-shaped containers of 8-oz. capacity, for example, may be produced at a rate of more than 300 per hour. A version of this machine arranged for extruding a variety of plastics is now in production and is said to be attracting much attention. A Latymer blow moulding machine was recently transported to France, by air, and installed in the customer's works, in less than 24 hours.

HARDINGE MACHINE TOOLS, LTD., Hampton Road West, Hanworth, Middlesex, are working to capacity on orders for their HCT, HLV and DV 59 centre lathes which are widely employed in Britain, Europe, and Commonwealth countries for turning parts to close limits of accuracy. A good demand is reported for collets and feed fingers and we may note that stocks of these parts are being built up in order to improve deliveries. The form tool department, also, continues to be active. Increasing interest is being shown in the Swiss-made Multifix range of holders which are designed to facilitate rapid tool changing on lathes and are distributed by the company in this country.

LENNIE & THORN, LTD., Western Road, Bracknell, Berkshire, are adding a large extension to

their shops which have been fully occupied with the production of precision parts for a considerable period. The additional space is to be used chiefly for the production of broaching fixtures in accordance with the company's policy of extending activities in this field of precision engineering.

E.M.O. INSTRUMENTATION, LTD., Western Road, Bracknell, are associated with the Barden Corporation, Danbury, Connecticut, U.S.A. Both companies specialize in the manufacture of ball bearings to close tolerances, and each may distribute the products of the other under a reciprocal trading agreement. The former has recently installed a PBX telephone system and the telephone number has been changed to Bracknell 2626 (8 lines). E.M.O. bearings are widely employed in instruments, small gearboxes, and miniature electric motors. Certain ball bearings, made to ABEC 7 and 9 tolerances, are frequently supplied for gyroscopes to be incorporated in very accurate control equipment.

F. W. HERRIDGE.

Stability of Gauge Blocks

(*Continued from page* 235)

indicated, however, it will be necessary to keep these blocks under observation for a considerably longer period before sustained stability can be assumed.

If the degree of stability sought can, in fact, be achieved, then to enable full advantage to be taken of the possibilities of improved accuracy that will thus be afforded, it will be necessary to develop equipment and techniques for measuring and comparing gauge blocks to corresponding standards of precision. Work is proceeding in this direction also, and the authors of the paper report that it has been found possible to use mechanical length comparators for measurements "with a precision approaching 0·2 micro-inch."

New Companies Registered*

MICROWAVE & SEMICONDUCTOR DEVICES. Registered July 6, 1961. Nom. cap.: £25,000 in £1 shares. Directors to be appointed by subscribers. Subscribers: M. K. Salter and K. Sellars, 59/67 Gresham Street, London, E.C.2.

RELION FORM TOOL CO., LTD., 241 Birchfield Road, Perry Barr, Birmingham. Registered June 30, 1961. Nom. cap.: £5,000 in £1 shares. Directors: N. F. Box, J. Biddulph, and J. Woodward.

BEDFORD ROCK DRILL COMPONENTS, LTD., Lion Works, Mowbray Street, Sheffield. Registered July 11, 1961. Nom. cap.: £100,000 in £1 shares. Directors: C. E. Holmstrom, A. Sellars, E. Ogden, D. J. Haggie, and R. Gray.

T. W. BARFOOT, LTD., Southway, Eastbourne Road, Seaford, Sussex. Registered July 12, 1961. To take over the business of general engineers and toolmakers carried on at Ordnance Buildings, Seaford, Sussex, by T. W. Barfoot, etc. Nom. cap.: £25,000. Directors: T. W. Barfoot, C. J. Barfoot and D. E. Haynes.

DELTA ENFIELD ROLLED METALS, LTD. Registered June 28, 1961. To take over the businesses of manufacturers and marketers of rolled copper, brass and bronze sheet and strip, and shapes cut from sheet and strip carried on by (1) Earle Bourne & Co., Ltd., (2) Alfred Case & Co., Ltd., and (3) Enfield Rolling Mills, Ltd. Nom. cap.: £2,700,000 in £1 shares. Directors not named. Subscribers: R. G. A. Youard, and M. Brothwood, 18 Austin Friars, London, E.C.2.

* From the lists compiled by Jordan & Sons, Ltd., Company Registration Agents, 116-118 Chancery Lane, London, W.C.2.

The Yard and the Pound

In connection with the Weights and Measures (No. 2) Bill which was published recently, it is pointed out that hitherto the yard and the pound have been defined as the length and the mass of two physical objects known as the Imperial Standards. Clause 1 of the Bill defines the yard and pound by reference to the metre and kilogramme, so assuring a constant relationship between the imperial and metric units. Since, moreover, by international agreement, the metre has recently been defined by reference to the wavelength of a Krypton-86 radiation, the yard will be of constant value in the future. It is stated that the value of the yard will be altered by only 3 micro-inches and that the pound will be affected even less.

Unified Miniature Thread Standard

British Standard 3369: 1961 is concerned with Unified miniature parallel screw threads from 1·4 down to 0·3 mm. diameter (0·0551 to 0·0118) in., with the 60 deg. 150/ Unified basic form of thread. It has been prepared as a result of discussions by the International Organization for Standardization, also discussions between the United Kingdom, Canada, and the U.S.A.

The specification covers thread form, diameter-pitch combinations and design sizes, limits, tolerances and inspection, and plated threads. It is recommended that the Unified miniature threads should be referred to on drawings and other documents by the basic, major diameters in millimetres, followed by the abbreviation UNM.

In connection with the field covered by this new standard, it is pointed out that whereas the special problems of miniature work have long been appreciated by those concerned with the production of clocks, watches, and certain instruments, they are now being encountered in other directions, and notably in telecommunication equipment manufacture, where miniaturization is being increasingly adopted.

Copies of the specification may be obtained from the British Standards Institution, 2 Park Street, London, W.1. [Price 5s.—postage extra to non-subscribers.]

Industrial Notes

C. A. Parsons & Co., Ltd., Newcastle-upon-Tyne, inform us that the address of their London office is now 40 Broadway, Westminster, S.W.1.

7th European Machine Tool Exhibition.—The offices of the Commissariat General, who are responsible for the organization of this Exhibition, have been transferred to Palais 10 Centenaire, Brussels, 2 (telephone, 79.18.00).

Dowty Hydraulic Units, Ltd., Ashchurch, Gloucestershire, have concluded a licence agreement with Kayaba Industry Co., Ltd., Tokyo, for the manufacture, in Japan, of Dowty hydraulic gear pumps and motors.

Johnson, Matthey & Co., Ltd., 73-83 Hatton Garden, London, E.C.1, have issued the first data sheets of a revised and enlarged series describing products for use in connection with the electrodeposition of silver, gold, palladium, rhodium, and platinum.

Northampton College of Advanced Technology, St. John Street, Clerkenwell, London, E.C.1, have issued a prospectus of part-time (day and evening) courses in engineering, applied mathematics, applied physics, and pure and applied chemistry, for the 1961-62 session.

Hall & Hall, Ltd., Oldfield Works, Hampton, Middlesex, manufacturers of the Hallprene range of fluid seals, have acquired a 50 per cent holding in J. A. Cannings, Ltd., of Weston, Bath. The latter company will continue to manufacture their J.6 range of mechanical seals for rotary applications.

Tecalemit, Ltd., is now a holding company only, and a new wholly-owned subsidiary, Tecalemit (Engineering), Ltd., has been formed to undertake the manufacturing, engineering, and selling activities of the organization. Correspondence should be addressed to this new company at Plymouth, Devon.

The Perkins Group, Peterborough, have received an order from the West German firm Gebr. Claas Maschinenfabrik, makers of combine harvesters, for diesel engines to the value of £2,000,000. Deliveries are to start immediately, and will be completed within 12 months.

Appleton & Howard, Ltd., Salisbury Street, St. Helens, have added a pump made from titanium to their Gush range. As a result of the interest shown abroad, they have appointed Carl Setterwall & Co., A.B., Stockholm, as their agents in Sweden.

Hilger & Watts, Ltd., 98 St. Pancras Way, Camden Road, London, N.W.1, have acquired the whole of the issued share capital of Microwave Instruments, Ltd., North Shields, Northumberland. The latter company make wave-guide components and microwave test equipment, which are complementary to those for millimeter wavelengths produced by Hilger & Watts.

Lec Refrigeration, Ltd., Bognor Regis, Sussex, have introduced a new low temperature refrigerator which is intended to meet the requirements, for example, of industrial training laboratories, universities, and technical colleges. The internal dimensions are 10 by 10 by 10 in. and it is stated that the temperature can be reduced to — 100 deg. F. in one hour.

Chamberlain Plant, Ltd., Crown Works, Southbury Road, Enfield, Middlesex, have opened an additional depot at Scotter Road, Scunthorpe, to serve the North Eastern area of the United Kingdom. Contractors' plant handled by this hire and sales company includes the Staffa Super-4 mobile crane and the Jenbach range of diesel-driven mobile air compressors.

Glacier Metal Co., Ltd., Alperton, Wembley, Middlesex, announce that arrangements are well advanced for the formation of a subsidiary company in South Africa to manufacture plain bearings for that market. The company will hold the major portion of the equity capital and production is expected to start in 9 to 12 months' time.

Allen West & Co., Ltd., Brighton, 7, have acquired the manufacturing interests of Digital Engineering Co., Ltd., 136 Battersea Park Road, London, S.W.11, and the latter firm will in future operate as a subsidiary from the present address. Products of Digital Engineering now range from performance recorders of various kinds to digital converters, rolling mill programming equipment, and complete on-line digital information handling schemes.

7th Elbourne Memorial Lecture.—The subject of the 7th Elbourne Memorial Lecture to the British Institute of Management, 80 Fetter Lane, London, E.C.4, will be "Leadership." This lecture will be delivered by Field-Marshal The Viscount Slim, K.G., at the Connaught Rooms, London, W.C.2, on November 8, at 6.30 p.m. Admission will be by ticket only, for which application should be made to the above address.

Dumas Group Travel, Ltd., 62 Aldgate High Street, London, E.C.3, inform us that they are organizing two flying "export" trips, each of 14 days' duration, to Continental trading centres, during September and October. The first trip will take in Oslo, Stockholm, Helsinki, and Copenhagen, and the second, Central Europe, Brussels, Zurich, Milan, and Vienna. Full particulars are obtainable from the above address.

Monks & Crane, Ltd., Garretts Green Lane, Birmingham, 33, have been appointed sole industrial distributors for all Molyslip products of the Slip Group of companies, and will deal with technical enquiries from industry. The range includes Industrial Molyslip for engines in all classes of vehicles, industrial lubricating oils for machine tools and plant, and greases and compounds for bearings, pumps, gears, wire ropes, and conveyors, for example.

Steel and Pig Iron Production.—The weekly output of steel in June averaged 447,500 tons compared with 466,100 tons in May and 466,400 tons in June, 1960. For pig iron, the corresponding figures were 297,400 tons,

300,200 tons, and 295,200 tons. For the first six months of the year steel production totalled 12,216,000 tons as against 12,386,000 in the first half of 1960. Pig iron production, however, showed an increase for the January-June period, from 7,873,000 tons in 1960 to 7,935,000 tons in 1961.

ASTON ALUMINIUM WAREHOUSES, LTD., 24-30 Clement Street, Birmingham, 1, will in future hold stocks of Noral 285 machining alloy, which is a product of Alcan Industries, Ltd. Intended specifically for use as screw machine stock, this material was previously available to order only. It is stated that the machining characteristics are very similar to those of free-machining brass, whereas the cost, volume-for-volume, is little more than half that of brass. Stocks of machining rod now held cover diameters from $\frac{1}{8}$ in. to 2 in., and the range of sizes is to be extended.

EXPORTS OF MANUFACTURES from 11 countries which accounted for 88 per cent of all such exports, other than those from U.S.S.R., Eastern Europe, and China, totalled 13,331 million U.S. dollars for the first quarter of this year, an increase of 4·2 per cent over the figure for the corresponding period of 1960. The leading exporting countries with their totals, in millions of U.S. dollars—partly estimated— and percentage changes, in parentheses, were as follows: U.S.A. (excluding special category goods), 2,856 (+6·7); Germany (Federal Republic), 2,624 (+8·8); United Kingdom, 2,242 (+2·6); France, 1,304 (—3·8); and Japan 839 (+7·7).

WELDING ENGINEERING 1962 is the title which has been selected for an exhibition to be held in the Winter Gardens at Buxton, from April 30 to May 4, 1962. It will be the first large scale exhibition organized by the Institute of Welding, 54 Princes Gate, Exhibition Road, London, S.W.7, and will be staged in connection with the spring meeting. It will cover welding and such allied processes and techniques a brazing, soldering, cutting, hard-facing, and metal spraying, also manipulating, inspection and safety. In addition, there will be sections devoted to research, education, and publications.

MOORE SPECIAL TOOL CO., Bridgeport, Conn., U.S.A., now guarantee that "the basic locating features of the standard No. 3 Moore jig borer and No. 3 jig grinder will not wear or deviate in normal use beyond tolerances over a 10-year period more than 50 micro-inches for lead screws, 15 micro-inches for jig borer quill fit, 50 micro-inches for jig grinder vertical slide fit, 20 micro-inches for compound slide squareness, 30 micro-inches for base ways and table ways, and 50 micro-inches for squareness of spindle to plane of travel." Published tolerances for longitudinal travel, cross travel, and squareness range from 30 to 90 micro-inches.

Moore Special Tool Co. are represented in this country by Catmur Machine Tool Corporation, Ltd., 103 Lancaster Road, London, W.11.

Obituary

MR. ROBERT H. PICKLES, works director of John Pickles & Son (Engineers), Ltd., Hebden Bridge, died recently at the age of 55. He had spent the whole of his working life with the company.

Personal

SIR PETER ROBERTS, Bart., M.A., M.P., has resigned from the board of Staveley Industries, Ltd., 1 Chester Street, London, S.W.1, owing to pressure of other business commitments.

MR. FRANK BRADFORD, general manager of the Production Products Division, and MR. FRANK SMITH, M.Inst. M.S.M., A.M.I.Mech.E., general sales manager, have been co-opted to the board of directors of Headland Engineering Developments, Ltd., 45-46 Lower Marsh, London, S.E.1.

The following new appointments have been announced:—

MR. J. A. V. WATSON, O.B.E., as assistant managing director of Castrol Industrial, Ltd., on the retirement of Mr. W. F. List on January 1, 1962.

MR. J. F. D. WOOD, A.M.I.C.E., formerly general sales manager, as sales director of Sanders & Forster, Ltd., Stratford, a member company of the Chamberlain Group.

MR. M. J. B. HODGSON, B.Sc., A.M.I.Mech.E., as area manager for the Midlands for Rhodes, Brydon & Youatt, Ltd., at their offices in Griffin House, Ludgate Hill, Birmingham, 3. He was previously area manager for the Northern counties.

MR. K. A. YARKER as home sales manager, and MR. W. K. BURDIS as export sales manager of Clarkson (Engineers), Ltd., King Edward Road, Nuneaton. These appointments have been made in accordance with the company's policy of continually expanding the sales organization.

MR. L. K. LORD, who has been general manager since 1955, as director and general manager, MR. R. E. GRAINGER, as director and secretary, and MR. H. B. MORRIS, a director of Wickman, Ltd., as a director of Arthur Scrivener, Ltd., Tyburn Road, Birmingham, 24. The latter company is a wholly-owned subsidiary of Wickman, Ltd.

Alfred Herbert Board Changes

Mr. B. C. Harrison, M.I.Mech.E., M.I.Prod.E., director of design of Alfred Herbert, Ltd., Coventry, has been elected deputy managing director. He was apprenticed to the company in 1924, and after holding the position of section leader in the drawing office, was appointed factory planning manager in 1940. Mr. Harrison was elected to the board as works director in 1947, and became director of design in 1955.

Mr. B. C. Harrison

Mr. J. W. Ellson, who has been a member of the board since 1937, and has completed 42 years' service with the company, is retiring at his own wish, but at the request of the chairman Col. C. W. Clark, D.S.O., O.B.E., M.C., he has agreed to, undertake lighter duties in order that his long and valuable experience may still be available to the company.

Mr. S. A. B. Muirhead, M.I.Mech.E., works director of the parent company, will in future be responsible for the production activities of the main subsidiaries in Birmingham, Leicester, Harlow, and Letchworth. He joined the company in 1919 became a section leader in the drawing office in 1927 and planning engineer in 1931. Mr. Muirhead was appointed manager to open the new Herbert factory in Lutterworth in 1941; deputy director of works in 1950; and director of production in 1953.

Mr. A. E. Smith, F.C.A., has been appointed to the board as deputy financial director. He joined the company last April.

Scrap Metals

†LONDON.—‡Prices per ton for non-ferrous scrap metals free from iron are as follows:—Clean copper wire, untinned and free from lead and solder, £200; clean heavy copper, untinned and free from lead and solder, £194; copper wire No. 2, £190; clean light copper, £186; braziery copper, £163; gunmetal, £174; brass, mixed, £126; lead, net, £51; zinc, £40; cast aluminium, £93; old rolled aluminium, £96; battery lead, £26; unsweated brass radiators, £102; hollow pewter, £565; black pewter, £445.

MIDLANDS.—There has been very little alteration in the values of copper and tin—perhaps a slight increase for the former and an easing of the latter. Whereas there is ample production of copper a certain amount of concern still exists as regards tin. Demand for copper remains fairly strong and this may have an influence in keeping prices at the present level, as stocks are plentiful to meet all requirements. Merchants have been keen to move as much material from stock as possible before the beginning of the annual holidays, and in consequence there have been increased demands on transport. In recent weeks, there has been a stronger tone in the market for nickel anode scrap, and prices generally have increased by £40 to £50 per ton.

The general position as regards various types of scrap is as follows:—

Copper.—Prices and demand remain firm. There is a tendency for more emphasis to be placed on quality, especially with braziery material.

Brass.—Ready outlets exist for all grades. Mixed solid scrap is about equal in value to rod swarf.

Gunmetal.—There is a strong demand by ingot makers and prices are being maintained at the levels prevailing in recent weeks.

Lead.—A slightly higher demand has been evident lately, and has resulted in an increase in price of £1 to £2 per ton. The market is still dull, but this slight improvement in value will result in some merchants' stocks being cleared.

Aluminium.—New cuttings and castings are favoured in preference to old cast and rolled scrap. Prices are slow to improve with a very dull market.

Zinc.—Values in general have remained fairly steady.

† George Cohen, Sons & Co., Ltd., 600 Wood Lane, London, W.12
‡ Subject to market fluctuations.

Machine Tool Share Market

Stock markets, which had been firm in mainly quiet conditions, suffered a sharp setback following the Chancellor's proposals for dealing with the economic situation, but subsequently there was a good recovery, and the period under review finished on a fairly steady note.

The gilt-edged section, after displaying an improving trend for the most part, reacted towards the end, and lower levels were recorded for British Funds and kindred issues.

Early firmness in the commercial and industrial sections gave place to unsettled conditions, but after widespread declines, the general tone steadily strengthened, and final prices were above the lowest.

Among machine tool issues, Edgar Allen advanced 6d. to 37s.; Asquith Machine Tool, 3d. to 9s. 3d.; Birmingham Small Arms, 1s. to 23s. 6d.; Chas. Churchill, 4½d. to 8s. 10½d.; Coventry Gauge & Tool, 6d. to 27s. 6d.; Craven Bros. (Manchester), 10½d. to 8s. 10½d.; Alfred Herbert, 3s. 9d. to 66s. 3d.; John Holroyd "A," 2s. 6d. to 20s.; John Holroyd "B," 1s. to 18s. 6d.; Samuel Osborn, 3d. to 48s. 3d.; and Tap & Die Corporation, 9d. to 16s. 3d. On the other hand, Arnott & Harrison lost 3d. at 8s. 9d.; British Oxygen, 6d. at 21s.; Brooke Tool, 1s. at 8s. 10½d.; Clarkson (Engineers), 6d. at 37s. 6d.; H. W. Kearns, 6d. at 22s.; Ambrose Shardlow, 7½d. at 57s. 6d.; John Shaw & Sons (Wolverhampton), 3d. at 16s. 9d.; and Stedall & Co., 6d. at 7s. 3d.

COVENTRY GAUGE & TOOL CO., LTD.—Interim dividend of 3d. per share, tax free, as compared with 2½d., tax free.

ALFRED HERBERT, LTD.—Interim dividend 2½ per cent, tax free (same).

NOBLE & LUND, LTD.—Interim dividend 5 per cent (same).

B. & S. MASSEY, LTD.—Final dividend 10 per cent, making, with the interim, a total distribution of 15 per cent for the year to March 31, as compared with 12½ per cent.

JOHN SHAW & SONS (WOLVERHAMPTON), LTD.—Dividend 17½ per cent (same).

Machine Tool Research President

The Rt. Hon. the Earl of Halsbury has been elected president of the Machine Tool Industry Research Association, 28 Deansgate, Manchester, 3. He has played an important part in the application of scientific research and has many connections with the machine tool industry. From 1949 to 1959 he was the first managing director of the National Research Development Corporation.

COMPANY		Denom.	Middle Price
Abwood Machine Tools, Ltd.	Ord.	1/-	1/9
Allen (Edgar) & Co., Ltd.	Ord.	£1	37/-
" "	5% Prf.	£1	13/-*
Arnott & Harrison, Ltd.	Ord.	4/-	8/9
Asquith Machine Tool Corp., Ltd.	Ord.	5/-	9/3
" " "	6% Cum. Prf.	£1	16 6
Birmingham Small Arms Co., Ltd.	Ord.	10/-	23/6
" " "	5% Cum. "A" Prf.	£1	14/6
" " "	6% Cum. "B" Prf.	£1	17/-
" " "	4% 1st Mort. Deb.	Stk.	90½
British Oxygen Co., Ltd.	Ord.	5/-	21/-
" "	6% Cum. Prf.	£1	19/-
Brooke Tool Manufacturing Co., Ltd.	Ord.	5/-	8 10½
Broom & Wade, Ltd.	Ord.	5/-	22 6
" "	6% Cum. Prf.	£1	16/6
Brown (David) Corporation, Ltd.	5½% Cum. Prf.	£1	15/-
Buck & Hickman, Ltd.	6% Cum. Prf.	£1	17/-
Butler Machine Tool Co., Ltd.	Ord.	5/-	16/3
" " "	5% Cum. Prf.	£1	14/3
Churchill (Charles) & Co., Ltd.	Ord.	2/-	8 10½
" " "	6% Cum. Prf.	£1	25/7½‡
Clarkson (Engrs.), Ltd.	Ord.	5/-	37 6
Cohen (George), 600 Group, Ltd.	Ord.	5/-	11 3
" " "	4½% Cum. Prf.	£1	11 6
Coventry Gauge & Tool Co., Ltd.	Ord.	10/-	27,6xd
" " "	5% Cum. Red. Prf.	£1	16/3
Craven Bros. (Manchester), Ltd.	Ord.	5/-	8/10½
Elliott (B.) & Co., Ltd.	Ord.	1/-	2,6
" "	4½% Red. Cum. Prf.	£1	12/-
Firth Brown Tools, Ltd.	4% Cum. Prf.	£1	10 6
Greenwood & Batley, Ltd.	Ord.	10/-	20/1½
Harper (John) & Co., Ltd.	Ord.	5/-	7 7½xd
" " "	4½% Red. Cum. Prf.	£1	11/7½
Herbert (Alfred), Ltd.	Ord.	£1	66 3
Holroyd (John) & Co., Ltd.	"A" Ord.	5/-	20/-
" "	"B" Ord.	5/-	18/6
Jones (A. A.) & Shipman, Ltd.	Ord.	5/-	22/6
" " "	7% Cum. Prf.	5/-	4/9
Kearney & Trecker-C.V.A., Ltd.	5½% Red. Cum. Prf.	£1	11/-
" " "	Prefd. Ord.	£1	13/9
Kearns (H. W.) & Co., Ltd.	Ord.	5/-	22/-
Kerry's (Gt. Britain), Ltd.	Ord.	5/-	9,6
Macreadys Metal Co., Ltd.	Ord.	5/-	16/6
Martin Bros. (Machinery), Ltd.	Ord.	2/-	2/6
Massey (B. & S.), Ltd.	Ord.	5/-	11/-xd
Newall Engineering Co., Ltd.	Ord.	2/-	8/-
Newman Industries, Ltd.	Ord.	2/-	7/-
" "	6% Prf. Ord.	5/-	5/-
Noble & Lund, Ltd.	Ord.	2/-	6/-
Norton, W. E. (Holdings), Ltd.	Ord.	2/-	8 6
Osborn (Samuel) & Co., Ltd.	Ord.	5/-	48/3
" " "	5½% Cum. Prf.	£1	22/-
Pratt (F.) & Co., Ltd.	Ord.	5/-	18/3
Sanderson Kayser, Ltd.	Ord.	10/-	32/6
" "	6½% Cum. Prf.	£1	16/3
Scottish Machine Tool Corporation, Ltd.	Ord.	4/-	9/-
Shardlow (Ambrose) & Co., Ltd.	Ord.	£1	57/6
Shaw (John) & Sons, Wolverhampton, Ltd.	Ord.	5/-	16,9
Sheffield Twist Drill & Steel Co., Ltd.	Ord.	4/-	19/3
" " " "	5% Cum. Prf.	£1	13/3
Stedall & Co., Ltd.	Ord.	5/-	7 3
Sykes (W. E.), Ltd.	"B" non-voting Ord.	10/-	28,9
Tap & Die Corporation, Ltd.	Ord.	5/-	16/3
" " "	4½% Deb. 1961-1977	Stk.	82½
Wadkin, Ltd.	Ord.	10/-	26/-
Ward (Thos. W.), Ltd.	Ord.	£1	67/6
" "	5% Cum. 1st Pref.	£1	13/6
" "	5% Cum. 2nd Pref.	£1	21/6
Willson Lathes, Ltd.	Ord.	1/-	3/-

The Middle Prices given in the list are in several cases nominal prices only and not actual dealing prices. Every effort is made to ensure accuracy, but no liability can be accepted for any error. * Sheffield price. ‡ Birmingham price.

PRICES OF MATERIALS

All prices per ton except where otherwise stated.

Pig Iron

Foundry and Forge

No. 3, Class 2	
Middlesbrough (10 tons or over)	£21 17 0
Birmingham (10 tons or over)	£21 9 3
Phos. Over 0·1 up to 0·4%	
Birmingham (6 ton lots)	£23 5 0
Grangemouth (6 ton lots)	£23 10 0
Hæmatite	
English No. 1 (10 tons or over)	
N.E. Coast (made in N.E.)	£23 19 0
Scotland	£24 5 6
Sheffield	£25 9 0
Birmingham	£25 13 0
Welsh 10 tons or over	£23 19 0

Steel Products

Medium plates (50 tons and over)	£43 16 6
Mild steel plates, ordinary (50 tons and over)	£40 7 0
Boiler plates (50 tons and over)	£42 17 0
Flat bars, 5 in. wide and under (50 tons or over)	£39 1 0
Round bars, under 3 in. (50 tons or over)	£39 1 0
Billets, rolling quality, soft U.T. (100 tons or over)	£31 15 6

Phosphor Bronze

Ingots (288) (A.I.D.) d/d	£315 0 0

Copper

Cash (mean)	£230 17 6
Cold rolled and hot rolled sheets 4 ft. by 2 ft. by 10 SWG	£305 15 0—£306 5 0
Rods, $\frac{7}{16}$ in. to $\frac{1}{2}$ in. diam.	£321 0 0
Tubes, $1\frac{1}{4}$ in. bore by 10 SWG, ton lots, per lb.	3s. $1\frac{1}{2}$d.
Wire rod, black, hot-rolled ($\frac{1}{2}$–$\frac{7}{16}$ in.), English	£246 7 6

Zinc

Refined, minimum 98 per cent purity, current month (mean)	£78 3 9

Brass

Tubes, solid drawn, basis per lb.	1s. $9\frac{3}{4}$d.
Strip 63/37, 6in. by 10 SWG coils, ton lots	£256 10 0—£259 10 0
Rods, $\frac{1}{2}$–3 in. diam. (59 per cent copper)	2s. $0\frac{3}{4}$d.

Yellow Metal

Condenser plates, per ton	£186 0 0
Rods, per lb.	2s. $1\frac{3}{4}$d.

Aluminium

Ingots, min. 99·5 per cent Canadian d/d	£186 0 0

Tinplates

*U.K. Home trade: Cold reduced, f.o.r. makers works (15-50 tons)	£3 6 8
U.K. Export: Hot rolled basis, f.o.r. works port	73s. 6d.—76s. 0d.
Cold reduced basis, f.o.r. works port	73s. 6d.—76s. 0d.

Gunmetal

Ingots, B.S. 1400 L.G.2, delivered	£219 0 0

* Official maximum price, after allowing for adjustments for increase in price of tin.

MAKERS' PRICES

Hexagon Steel Bars[1]

Sizes in inches from 1 in. up to 2·21 and 2·41 a/f ex works, 2 tons basis	£42 17 6†
Free cutting black	£46 14 6†

Reeled Steel Bars[1]

Single-reeled, $1\frac{1}{4}$ in. upwards, f.o.t. works (+ usual extra for sizes)	£43 9 0†
Free cutting	£47 7 0†

Precision-ground Mild Steel[2]

1-in. diam. ± 0·00025-in. 4-ton lots, per cwt.	124s. 6d.

Bright Ground Stainless Steel Bars[3]

EN56AM (martensitic, free cutting)	£304 10 0
EN58AM (austenitic free cutting)	£377 10 0

Prices are basic, subject to extras.

High-speed Steel

Black random length bar. All prices basic, per lb., subject to extras:

Molybdenum "66"	6s. 5d.
Molybdenum "46"	6s. 3d.
14 per cent tungsten	6s. 11d.
16 per cent tungsten	7s. 4d.
18 per cent tungsten	7s. 9d.
22 per cent tungsten	9s. 2d.
5 per cent cobalt	10s. 10d.
4·75/5·25 molybdenum + 6·0/6·75 tungsten + 1·75/2·05 vanadium per cent (5-6-2)	6s. 7d.

Precision-ground, High-speed Free-turning Brass Rod[2]

$\frac{1}{8}$-in. diam. ±0·00025-in., 2 ton lots, per lb.	2s. $7\frac{1}{2}$d.

Grey Iron Rod

Die Cast[4] in random lengths 18 in. to 26 in. rough machined $\frac{1}{32}$-in. above listed size. Extra for definite lengths. Discounts for orders over £150.

	Per cwt. net. Mark I	Mark III
$\frac{3}{4}$ or $\frac{7}{8}$ in.	260s. 3d.	338s. 3d.
1 or $1\frac{1}{8}$in.	208s. 4d.	267s. 3d.
$1\frac{1}{4}$ to $1\frac{3}{4}$ in.	146s. 3d.	181s. 7d.
$1\frac{7}{8}$ to 2 in.	112s. 7d.	133s. 6d.
$2\frac{1}{4}$ to $3\frac{1}{4}$ in.	97s. 1d.	112s. 9d.
$3\frac{1}{2}$ to 12 in.	91s. 9d.	105s. 3d.

Continuous Cast

10-ft. lengths, centreless machined 1 to 3-in. diam. + 0·010 to 0·020 in., prices as quoted for die cast bar[4]		
centreless ground 1 or $1\frac{1}{4}$ in. + 0·010 in. Extra		208s. 4d.
for hardenable alloy iron[5]	$1\frac{1}{2}$ to $1\frac{3}{4}$ in.	146s. 3d.
	$1\frac{7}{8}$in. to 2 in.	112s. 7d.
Per cwt. net	$2\frac{1}{4}$ to $3\frac{1}{4}$ in.	97s. 1d.

Stellite[6]

Welding Rods, plain

$\frac{1}{4}$ in. diam., per lb.	30s. 0d.

Toolbits

$\frac{1}{4}$ in. sq. × in., each	22s. 3d.

[1] Colvilles, Ltd., Glasgow, and 17 Grosvenor Street, London, W.1. [2] Pratt, Levick & Co., Ltd., Chester. [3] Spartan Steel & Alloys, Ltd., St. Stephens Street, Birmingham, 6. [4] Sheepbridge Alloy Castings, Ltd., Sutton-in-Ashfield. [5] "Flocast," Harold Andrews Sheepbridge, Ltd., Halesowen. [6] Deloro Stellite, Ltd., Highlands Road, Shirley, Solihull.

† Plus 1 per cent.

BASIC PRICES FROM LONDON STOCK[6]

Free Cutting Steel

Bright cold drawn: (Usaspead) over 1 to 2 in.	£59 4 6‡
Lead bearing (Usaled)	£63 11 0‡
Precision ground, $1\frac{3}{4}$ in.	£84 14 6‡

Bright Drawn

M.S. bars (M.M.C.) over $1\frac{1}{4}$ to 2 in.	£56 10 0‡
Square edge flats (Usaflat)	£73 6 6‡
M.S. angles (Usaspead)	£100 6 6‡
Case hardening (EN) (Usacase over $1\frac{1}{4}$ to 2 in.	£62 10 0‡
M.S. bars (EN3B) (Usamild) over $1\frac{1}{4}$ to 2 in.	£58 16 6‡
Carbon manganese semi-free cutting case hardening (EN202) (Usaspead 202) over $1\frac{1}{4}$ to 2 in.	£71 5 0‡
35/45 ton tensile (EN6) (Usen) over 1 to $1\frac{1}{4}$ in.	£67 3 0‡
0·4 carbon normalized (Usaspead "40") over $1\frac{1}{4}$ to 2 in.	£69 5 0‡
0·45 carbon normalized EN9 (Usaspead 55)	£69 15 0‡
Carbon manganese steel to Specification EN16T (Usaspead 5565), per ton	£126 17 0‡

Ground Flat Stock

18-, 24-, and 36-in. lengths (Usaspeed). List prices plus 10 per cent, less 5 per cent.

Oil Hardening Cast Steel

Non-shrink (Usaspead N.S.O.H.), $\frac{3}{4}$ in. to $2\frac{1}{4}$ in., per lb.	1s. 11d.
Non-distorting heavy duty (Usaspead H.C.H.C.), $\frac{3}{4}$ in. to $2\frac{1}{4}$ in., per lb.	4s. 2d.

Silver Steel

(0·194-in. to $1\frac{1}{4}$-in.) Genuine Stubs quality, per lb.	4s. 10d. less 27½%
M.M.C. quality, per lb.	2s. 8d. + 6½%
Boxes of 16 assorted sizes, $\frac{1}{16}$ in. to $\frac{3}{4}$ in. diam.	7s. 6d.

Stainless Steel

KE40AM (free cutting), per lb.	3s. 8d

Glacier Machined Bronze Bars

Phosphor bronze (288) / Lead bronze	Prices on application

High-speed Steel

18 per cent tungsten. Prices on application

Toolholder bits:

Usaspead "Super" / " "Supreme" / " Cobalt 10	List price

Shimstock

Steel assorted, per tin	3s. 6d.
Brass " "	7s. 3d.

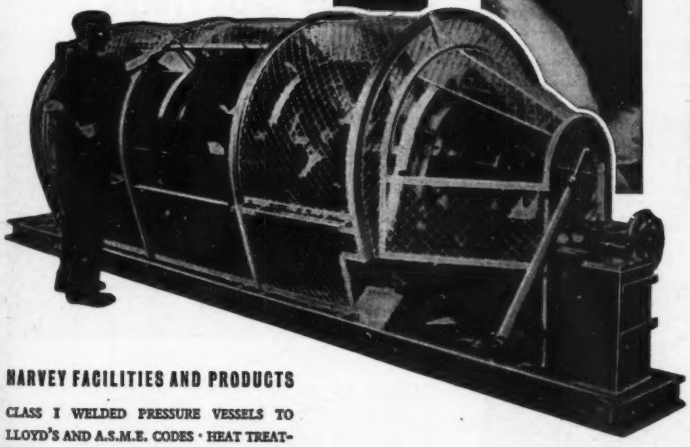
[6] Macready's Metal Co., Ltd., Pentonville Road, N.1. Subject to confirmation by London Office. Delivered free by van in London area.

‡ Plus 1 per cent.

SENSIBLE SAFETY

Everybody understands why dangerous animals have to be kept behind bars, and so instances of people being injured by caged wild animals are fortunately rare.

Moving machinery and tools can also inflict serious injury, and it is no less important that these, too, should be securely guarded and fenced.



Safety First with

'HARCO' MACHINERY GUARDS

'Harco' Machinery Guards are purpose made for every type of machinery, and are constructed to afford complete protection without interfering with efficient operation. They are strongly made from stout wire mesh to withstand vibration and rough treatment, and all 'Harco' Guards fully conform to Factory Act requirements. The complete Harvey service covers advice, design and installation, and List No. 996 shows many types already supplied.

HARVEY FACILITIES AND PRODUCTS

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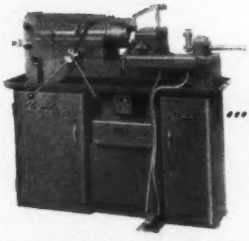

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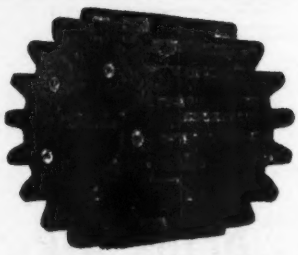

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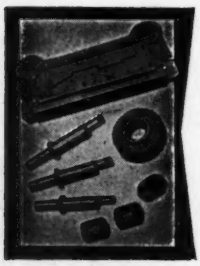

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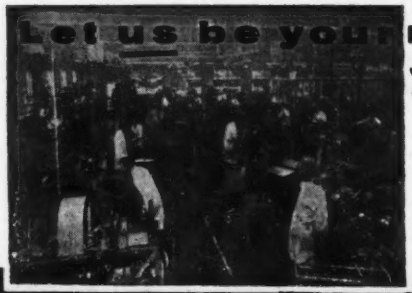

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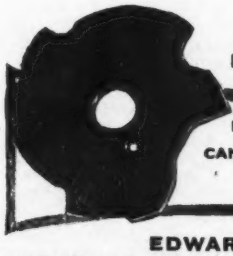

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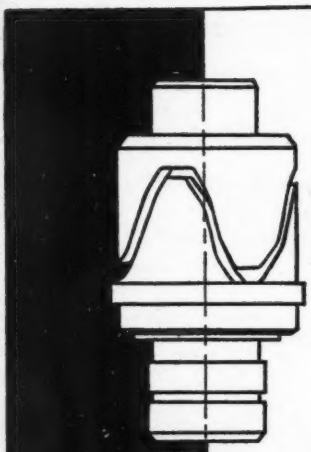

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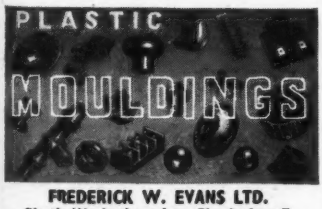

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The Proprietors of Patent No. 729683, for "Improvements in or Relating to the Feeding of Abrasive Composition to Grinding Tools," desire to secure commercial exploitation by Licence or otherwise in the United Kingdom.—Replies to Haseltine Lake & Co., 28, Southampton Buildings, Chancery Lane, London, W.C.2.

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WADKIN High Speed Vertical, Table 35in. × 13in.

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HERBERT No. 2S & IS and O.
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BLISS No. 8 Power Press.
FLY PRESSES, Nos. 3, 4, 5, 6.
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Classified Advertisements (PLANT FOR SALE, contd.)

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LELAND GIFFORD 3-spindle Drilling Machine, mounted on 4-spindle base. Spindles No. 3 M.T.
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JONES & SHIPMAN 4-spindle Drilling Machine, No. 2 Morse Taper.
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TAYLOR, TAYLOR & HOBSON Model A Bench Engraving Machine. (New.)
DECKEL Engraving Machine.

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CRYPTO Horizontal Bandsawing Machine.
WELLS Horizontal Bandsawing Machine, 16in. × 5in. capacity.
GROB Model A3 Band Filing Machine, table 25in. × 17in.
RAPIDOR Motorised Filing and Sawing Machine. Table 15in. × 15in.

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CHURCHILL-CLEVELAND Rigidhobber, 6in. dia. × 9in. face, 3 d.p.
BARBER COLMAN 12in. Gear Hobber.
FELLOWS No. 645A3 Gear Shaper, 18in. × 3in.

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BETTS-BRIDGEFORD 30in. swing × 22ft. Lathes, 16ft. between centres.
OLDFIELD & SCHOFIELD 21in. centre × 15ft. Gap Bed Lathe, 6ft. between centres 4¼in. hollow spindle, 62in. swing in gap.
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DEAN, SMITH & GRACE 6¼in. centre 13Z Lathe.
LANG JUNIOR 6¼in. × 6ft. Lathe, 30in. between centres.
LANG 24in. Surfacing and Boring Lathe.
LE BLOND 10in. Rapid Production Lathe, 7ft. between centres.
CROMWELL 3¼in. × 40in. Lathe, stepless speeds to 2,000 r.p.m.
SMART & BROWN 4¼in. Sabel Lathe.

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CHURCHILL 12in. × 36in. Hydraulic Universal Grinding Machine, with internal spindle.
BROWN & SHARPE 12in. × 30in. Universal Grinding Machine.
CHURCHILL 18in. × 6in. Model O Universal Tool and Cutter Grinding Machine.
CHURCHILL 8in. × 16in. Model O Semi-Universal Grinding Machine.
RILLETER twin head Radial Arm Open Sided, Hydraulic Slideway Grinder. Table 9ft. 8in. × 2ft. 3in., infinitely variable table speeds 6ft. 6in. to 38ft. per min., push button control, rapid traverses, telescopic bed covers.
CHURCHILL 24in. × 6in. Horizontal Spindle Surface Grinding Machine.
SUPERIOR Horizontal Surface Grinder, 15in. × 5in., hand feed. (New.)
BROWN & SHARPE 18in. × 6in. Horizontal Surface Grinding Machine.
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JUNG 18in. × 6in. Hydraulic Horizontal Surface Grinder.
WRIGHT 12in. Table Surface Grinder.

389-361, EUSTON RD., LONDON, N.W.1
Telephone: EUSTON 5000 *Telex: 24264*
And at Lansdowne House, 41, Water St., Birmingham, 3 *Telephone: Central 7606-8*

Cashmores

Selection of Machine Tools from Stock

CENTRE LATHES

MITCHELL OF KEIGHLEY 8½in. S.S. & S.C. Lathe to admit 4ft. 3in. between centres.
MITCHELL OF KEIGHLEY 10½in. S.S. & S.C. Lathe to admit 4ft. 0in. between centres.
VOLMAN 8in. S.S. & S.C. Gap Bed Lathe, to admit 4ft. 6in. between centres.

BORING MACHINE

WEBSTER & BENNETT 36in. Vertical Boring Mill, table speeds 5.6/125 r.p.m.

DRILLING MACHINES

SWIFT 4ft. 6in. Model A1 Elevating Arm Radial Drilling Machine, No. 4 M.T. spindle, motorised 400-440/3/50 cycles.
New **KITCHEN-WALKER** 4ft. 6in. Radial Drilling Machine, No. 5 M.T. spindle.

GRINDING MACHINE

NORTON 6in. × 30in. Hydraulic Plain Cylindrical Grinding Machine, maximum wheel diameter 20in.

MILLING MACHINES

HYPERMILL 7/27 Production Type Milling Machine, 43in. × 10in. table.
MIDGLEY & SUTCLIFFE Hand Lever Feed Milling Machine, 16in. × 5in. table.
EDGWICK No. 2 Dial Type Plain Horizontal Milling Machine, 46in. × 11in table.
ARCHDALE 20in. Dial Type Horizontal Milling Machine, 40in. × 12in. table.
GREENWOOD & BATLEY Plain Horizontal Milling Machine, working surface of table 20in. × 10in.
EDGWICK 18in. Horizontal Plain Production Milling Machine, with 40in. × 12in. table.

POWER HAMMER

MASSEY 5 cwt. Pneumatic Side Type Power Hammer.

SAWING MACHINES

WICKSTEED 10in. capacity Heavy Duty Power Hacksaw.
New **WICKSTEED** 10in. capacity Power Hacksaw.
New **STARTRITE-SABRE** Vertical Metal Cutting Bandsaw, 20in. throat.

SLOTTING MACHINES

BUTLER 14in. stroke All Geared Slotting Machine with 39in. diameter rotary table.
DUTRANNOIT 24in. stroke Precision Slotting Machine with swivelling head, 39½in. table.

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SHEARING MACHINE

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LANG Junior 17in. × 60in. S.S. & S.C.
LE BLOND 15RP S. & S., 15in. × 24in.
CRAVEN 36in. Swing × 12ft. Between S.S. & S.C.
SMART & BROWN 4in. × 18in. S.S. & S.C.
LANG 36in. Surfacing and Boring.
ACME No. 5W Capstan, chuck machine.
RYDERMATIC No. 12 Multi-Tool.
D.S.G. 13Z Minor S.S. & S.C.
WILLSON 6¼in. × 36in. Gap Bed S.S. & S.C.

CAPSTANS AND AUTOS

WARD No. 7 Capstan, chucker.
HERBERT 4B D/L chuck and bar feed.
HERBERT 2S air-operated chucker.
TAYLOR No. 1263 Capstan, ¼in. cap.

DRILLS

HERBERT Type "V" Junior Geared Pillar.
HERBERT Type "V" Pillar.
HERBERT Type "C" Pillar.
FOSDICK 4 BM. 3 spin. H/Sp.
CORONA 3M Pillar, 1¼in. cap.
KITCHEN & WADE 2ft. 6in. Radial, 2in. capacity.
CORONA Model 9FX Super High Speed Bench.

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CHURCHILL Mod. H.C.B. Internal Auto Size.
HAHN & KOLB Hyd. Disc Lapping M/c.
JACKMAN No. 22 Disc, 18in. dia.
LUMSDEN Mod. 12M. Tool, 14in. × 2 wheel

MILLERS—Vertical

CINCINNATI Model O8 Production.
KENDALL & GENT Duplex Profile, table 18in. × 15in.

MILLERS—Horizontal

CINCINNATI No. 2 MH. Plain High Speed.
CINCINNATI Mod. O8 Plain Automatic.
BROWN & SHARPE No. 000 Plain Auto Miller.
BROWN & SHARPE No. 2 Universal, light type.
RICHMOND 2H8 Plain, table 35in. × 9in.
ARCHDALE 20in., table 40in. × 10in.
ASQUITH H.K.1 Duplex Keyway, table 43in. × 10in.
CINCINNATI Mod. O.K. Prod., table 34in. × 12in.
ARCHDALE 14in. Plain, table 27in. × 8in.
ARCHDALE 28in. Plain, table 49in. × 13in.

SAWING MACHINES

EHJ No. 13 Filing and Sawing.

SHAPERS

TOWN 14in.
HERBERT N.D. 20in.
ORMEROD 14in.

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MAXICUT Gear Shaper, Mod. No. 2.

MISCELLANEOUS

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TWO WARD 3A Capstan Lathes. Both equipped ball chuck and bar feed.

DRUMMOND Model K Capstan Lathe, arranged for chucking. 2 1/16in. Hollow spindle.

HERBERT No. 7 Junior Combination Turret Lathe. Flamard bed.

ONE HERBERT 2B Capstan Lathe, arranged for chucking.

HERBERT 1S Capstan Lathe, part bar feed.

TWO MOREY 2G Capstan Lathes, arranged for chucking.

INDEX No. 36 Single Spindle Automatic.

HERBERT 1¼in. Single Spindle Bar Automatic, with equipment.

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DISKUS Vertical Spindle Surface Grinder, hydraulic feeds. Table 53in. by 10in. 14in. dia. segmental wheel.

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EDGWICK No. 1 Keyseating Machine.

DAVID BROWN Worm Shaft Milling Machine, 4in. centres by 33in. between centres.

BROWN & SHARPE No. 2 Universal Milling Machine. Table W.S. 46in. by 10in. Spindle speeds 30-1,300 r.p.m. With high speed Vertical Milling Attachment, Slotting Attachment, Universal Dividing Head, chuck, change gears, rotary table, etc.

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ARCHDALE 20in. Plain Horizontal Milling Machine. Table W.S. 10in. by 31in. Dial change.

EDGWICK 18in. Plain Horizontal Milling Machine. Table W.S. 26in. by 7in. Spindle speeds 30-600 r.p.m.

ASQUITH Two Spindle Profile Milling Machine. Capacity 24in. by 28in. Spindle speeds 250 to 3,000 r.p.m.

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ALBA 18in. Crank Shaping Machine.

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GIDDINGS & LEWIS No. 25RT. Horizontal Boring Machine. Travelling Spindle and Facing Head. No. 4 Morse Taper. Spindle Dia. 2½in. Top Table 24in. by 24in.

DRILLING MACHINES

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GEAR CUTTING MACHINE

DAVID BROWN M.T.30 Gear Hobbing Machine. 1950.

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MORINI-BOSSE Capstan Lathe. (Equivalent to Ward 2A.)
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SWIFT 12½in. by 10ft. 6in. S.S. & S.C. Gap Bed Lathe. Spindle Bore 4½in.

MILLING MACHINES

MILWAUKEE 2K Vertical Milling Machine.
CINCINNATI No. 3 Dial Type Vertical Milling Machine.

PLANING MACHINES

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Cleveland 1 1/16 Model A Automatic. 400/3/50.—HICKS MACHINERY, LTD., 26, Addison Place, London, W.11. Tel. PARk 2333.

HERBERT No. 2B Geared Head Capstan Lathe. 5¼in. H.C. 1¼in. H.S. Power traverse. Modern Machine.
NORTON Crankshaft Grinder, 22in. swing × 72in. B.C.
BARDONS & OLIVER No. 3 Turret Lathe. Universal and Plain. 2in. bar capacity.
ADCOCK & SHIPLEY Model 2B Horizontal Miller. Table 37¼in. × 10in.
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CINCINNATI Model 4-36 Hydromatic *MILLING MACHINE*. Table size 18in. × 67in. 8 spindle speeds 20 to 150 r.p.m. through pick-off gears. 36in. hydraulic table traverse. Vertical adjustment of head 7in. Max. adjustment of quill 6in. Motor drive 415/3/50. Price: £1,250

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MYFORD DRUMMOND 3½in. Centre Lathe. £35
SMART & BROWN 4in. Centre Lathe. £110
SOUTHBEND S.S. & S.C. 4½in. Centre Lathe. £120

DRILLING MACHINES

ADCOCK & SHIPLEY Pillar Drill, No. 2 Morse. £65
SMITH & COVENTRY Pillar Drill, No. 2 Morse. £40
HERBERT ½in. cap. High Speed Bench Drill. £35

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COBURN 6ft. × 18 gauge Folding Machine. £90
BESCO 3½ft. × 18 gauge Folding Machine. £45
HILMOR Tube Bending Machine. £45

GRINDING MACHINES

ABWOOD Surface Grinding Machine (hand feeds), Model TH2AP. £375
CINCINNATI Plain Cylindrical Grinding Machine, 6in. × 24in. cap. £450
EXCEL No. 1 Bench Surface Grinding Machine. £85
JONES & SHIPMAN Universal Cylindrical Grinder, Model 1027. £750

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BEAVER Model A Turret Mill, 28in. × 6in. table. (As New.) £335
CINCINNATI No. 3 Sliding Head Vertical Dial Selection, 63in. × 15in. table. £750
CINCINNATI No. 3 Sliding Head Vertical, 55in. × 13½in. table. £350
VICTORIA V2 Swivel Head Vertical, 45in. × 11in. table. £900
DENBIGH C4 Universal Mill, 46in. × 10in. table, 2/1 vertical head. £395
MILWAUKEE No. 2 Horizontal, 50in. × 14in. table. £475
PARKSON 2P Horizontal, 52in. × 12in. table. £550

PRESSES

Fly Press No. 3 **NORTON.** £27
Fly Press No. 4 **VIZOR.** £27 10s.
Double Column Fly Press, screw dia. 2½in. £70
Bench Arbor Press. £12
Double Column Bench Arbor Press. £35

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INVICTA 6M Stroke Shaper. £500
HERBERT ND 20in. Stroke Shaper. £250
BUTLER Planer, 9ft. × 2½ft. table. £1,100
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HERBERT 1½in. Pedestal Drill.
CORONA 4ft. Radial Drill. £325.

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HERBERT HUNT Tap and Reamer. £65.
SCRIVENER No. 1 Centreless, with auto feed.
SMART & BROWN Internal Grinder. 1½in. Max.
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SOUTHBEND 6½in. Lathe T/T.
JOHNSTEAD 5ft. 6in. Facing Lathe.
MURAD ¾in. 3Q Capstan, full equip.
DARLING & SELLERS 10½in. × 12ft. T/T.
HASSE & WREDE 10in. × 42in.
OLDFIELD & SCHOFIELD 15in. × 60in. £650.
HERBERT SMALLPEICE, 6in. × 24in. Multi-tool.
RIVET Instrument Lathe, 4½in. × 24in.

MILLERS (Vert. and Horiz.)

A KERSHAW Vert. Mill 18in. × 7in.
RICHMOND 0.1 Horizontal 30in. × 8in.
CENTEC No. 3R Auto-cycle, pro mill.
HEY Duplex Spline Mill. £175.
ADCOCK & SHIPLEY IVM Vert. 25in × 7in. As new.

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BLISS 21B 60 ton geared. Adj. Str.
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BESCO 20 ton.
WARD 20 ton.
TAYLOR & CHALLEN 10 ton.
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BESCO 10 ton Power Press. £175.
E.M.G. 9-ton Airdraulic. £200.

MISCELLANEOUS

BOTNIA 5ft. × 18in. Planer.
RAPIDOR 8in. × 8in. heavy duty power saw.
MANURHIN TR12-16 ½in. Auto. 1958.
T.T. & H. Engraver CB with div. table.
MIDSAW 36in. Bandsaw.
BARBER & COLMAN 15in. Hobber.
THIEL Filing and Sawing Machine. £95.
HURTH Key Seating Machine. £225.
THIEL Punch Shaper.
ORMEROD 12in. Shaper with Cam Cutting Attach.
RAPIDOR 15in. × 15in. Filing and Sawing. £165.

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Newman

AUTOMATICS

BULLARD Multi-Au-Matic 7in. 8 spindle.
BULLARD Multi-Au-Matic 12in. 6 spindle.

BORING MACHINES

KEARNS Model OB Horizontal Boring and Facing Machine, 2½in. diameter travelling spindle (1957).
UNION Model BFT100 Horizontal Boring and Facing Machine, 4in. diameter travelling spindle (1955).
KEARNS Model OC Horizontal Boring Machine, 3in. dia. travelling spindle.
KEARNS No. 4 Horizontal Boring and Facing Machine, 4in. diameter travelling spindle.
WEBSTER & BENNETT Vertical Boring Machine, table 50in. diameter.
RICHARDS Type PRT Horizontal Floor Boring Machine, 3½in. travelling spindle, 28in. diameter facing head.

CAPSTAN AND CENTRE LATHES

CHURCHILL-REDMAN Model 13NM Heavy-Duty S.S. & S.C. Gap Bed Centre Lathe, 13in. centre height × 72in. between centres. Swing in gap 50in.
MITCHELL Model DM10 S.S. & S.C. Gap Bed Centre Lathe, 10½in. centre height × 7ft. 5in. between centres. (NEW.)
OLDFIELD & SCHOFIELD Surfacing and Boring Lathe, 10½in. centre height.
WARD 7B Combination Turret Lathe.
NILES Heavy Duty Centre Lathe, S.S. & S.C., 17in. centre height × 28ft. between centres.
U.L.R.O. Heavy Duty Centre Lathe, 16in. centre height × 30ft. between centres.

DRILLING MACHINES

HETTNER Radial Drilling Machine, 10ft. elevating arm.

GEAR MACHINES

ORCUTT Model HM24 Hydraulic Internal Gear Grinder.
GLEASON 3in. Straight Bevel Gear Generator.

GRINDING MACHINES

CRAVEN Roll Grinding Machine, capacity 20in. swing × 138in. between centres.
CHURCHILL Model HBY Internal Grinding Machine.
CHURCHILL Plain Cylindrical Grinding Machine, 26in. swing × 84in. between centres (1951).
LANDIS Type C Plain Hydraulic Cylindrical Grinding Machine, 6in. swing × 18in. between centres.
ORCUTT Model HM24 Internal Spur Gear Grinding Machines.
CHURCHILL Plain Hydraulic Cylindrical Grinding Machine, 20in. swing × 72in. between centres.
BROWN & SHARPE Plain Cylindrical Grinding Machine, 10in. swing × 36in. between centres.

MILLING MACHINES

CINCINNATI Model 5/72 Plain Hydromatic Milling Machine, table 91in. × 22in. (1952).
CINCINNATI No. 2L Plain Horizontal Milling Machine, table 52in. × 10in.
CINCINNATI No. 1M Vertical Milling Machine.
CINCINNATI No. 4 Dial Type Horizontal Milling Machine.
PRATT & WHITNEY Model BL3620 3-spindle "Keller" Die Sinking Machine.
CENTEC Model 3R Automatic Production Milling Machine, table 25in. × 16in.

MISCELLANEOUS

LANGE & GAILEN 28in. stroke Double Headed Hydraulic Shaping Machine.
TAYLOR & CHALLEN Double Sided 50-ton Geared Power Press, 10in. stroke.

NEWMAN INDUSTRIES LIMITED

Machine Tool Division: YATE, BRISTOL
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SWEENEY & BLOCKSIDGE Bench Press. Cap. 3 tons.

SAWING MACHINES
BARSON No. 1 Saw. 1¼in. rounds, 2in. tubes, 1¼in. × ¼in. flats. 1¼in. × ¼in. angles.

SCREWING MACHINES
KENDALL & GENT 3in. Screwing Machine. Leadscrew type.

POLISHING MACHINES
3 and 5 h.p. Double Ended Polishing Spindles.

WELDING EQUIPMENT
PRESCOTT 15 kVA Spot Welder.

CRANES
BROADBENT 40 Ton O.E.T. Crane. 10 ton auxiliary lift.

All machines 400/3/50 electrics unless otherwise stated

THE
MIDLAND MACHINE TOOL CO.
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Tel. Bilston 42471/9

Classified Advertisements (*PLANT FOR SALE, contd.*)

Richards No. 2 PRT Horizontal Boring and Facing Machine complete Live Spindle.

Further details from:—
C. & G. OLDFIELD LTD.,
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PAISLEY.

AUTOS
CONOMATIC 1¼in. 8-spindle Type W.W.

BORERS
RICHARDS Horizontal Borer 2A, with facing head.
JUNGENTHAL Vertical Borer. Chuck diameter 39in., maximum swing 46¼in.

DRILLING
ASQUITH 4ft. O.D.1 Radial Drill.
PROGRESS 5E Round Table.
ARCHDALE 28in. Heavy Duty Pillar Drill

GEAR SHAPING
MODEL 61 **FELLOWS** Gear Shaper. Straight spur 35in. dia. × 5in. face width.

LATHES
WARNER & SWASEY No. 2A Long Bed.
SOUTHBEND 16in.
EDGWICK 7in.
DEAN, SMITH & GRACE. Height of centres 7in.
MONARCH 22M S.S. Taper Turning Lathe.
WARD 10 Combination Turret Lathe.
WARD 2A.
WARD 3A. with Ball Chuck and Bar Feed.
HERBERT 4 with Flamard bed, draw back chuck and Bar Feed.

MILLING
28in. **ARCHDALE**, Rapid all ways.
18in. **EDGWICK** Production Mill.
CINCINNATI No. 5 High Power Plain Hor. 1942 Machine.
CINCINNATI No. 4 Vertical High speed, power down.
CINCINNATI No 3 Vertical medium speed, power down.
MILWAUKEE 2H Vertical—rebuilt.
MILWAUKEE 2HL Vertical—rebuilt.
MILWAUKEE 2K Plain—overhauled.
MILWAUKEE 3KM Universal, metric, with dividing head.
PEGARD Bed Type Vertical, table 84in. × 29in.—slightly used.

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GUILLOTINES
EDWARDS 6ft. × ⅛in. Overcrank.
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MACHINES NOW IN STOCK

TATE

BORING MACHINES
MATHEYS Model FPN/28 Semi Jig Borer.
PADDON MK3 type WP Cylinder Re-boring Machines.

CAPSTANS AND TURRET LATHES
BOLEY-LEINEN Model ER15 ¾in. Capstan (modern).
HERBERT No. 2 Pre-optive Bar Turret Lathe, Flamard bed, 2in. capacity with bar feed, full turret tooling.
HERBERT Model 22A Turret Lathe. 8¼in. S.P. Hole.
LIBBY 2H 8in. spindle Turret Lathe.

CENTRE LATHES
SOUTHBEND 7in. Centre Lathe.

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VICO (Swiss) Hydraulic Toolroom Universal Grinder 10in. by 30in.
LAMBERT Model 73 Watchmaker's Cutter Grinder (two)
CRAVEN Heavy Duty Roll Grinding Machine with capacity for rolls 42in. dia. by 12ft. between centres and fitted with automatic cambering. Will take rolls up to 25 tons weight. Fully motorised machine of modern design. WEIGHT 25 tons.
CRAVEN Heavy Duty Railway Wheel Lathe, swing 6ft: x 12ft. vee belt drive. Weight 25 tons.
9ft. Faceplate Lathe fitted chuck jaws.
WALDRICH SIEGEN Roll Grinder. 36in. by 13ft. between centres.
Two **CINCINNATI** No. 2 Tool and Cutter Grinding Machines.
COVEL No. 2 Tool and Cutter Grinding Machine.
IMPERIA Tool and Cutter Grinder, Model M6 AR.
MATRIX No. 16G Plain Straight Thread Grinder.
MATRIX No. 6 Internal Thread Grinders, 3in. by 10in.
HEALD Model 81 Sizematic Internal Grinder.
WOLTERS Model I.L.1 Hydraulic Internal Lapping Machine.
PETEWE Model 3D Profile Grinding Machine. (Nearly new.)

DIESINKING MACHINES
NASSOVIA Model V.11 Hydraulic Diesinker. Mould capacity 27½in. by 19½in. by 23in. height. (Unused.)
VICTORIA Duplomatic Hydraulic Copy Milling Machine, 8in. by 8in. (NEW).

DRILLING MACHINES
PACERA ½in. Bench Drill (New).
Two **ARCHDALE** 36in. Radial Drilling Machines. No. 4 M.T.
Two **CORONA** Model 31A Heavy Duty Pillar Drills. 15 HP Motors.
CRAFTSMAN ½in. Bench Drills; four at £25 each.
Various **ACIERA** Precision Bench Drills.

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BESCO 42in. by 10 s.w.g. Power Guillotine.
HANDS 4ft. by ⅛in. Guillotine.
RHODES 6ft. by ⅛in. Guillotine.

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DENBIGH Model No. C4 Horizontal Milling Machines.
VICTORIA Junior Mill (new).
SANT ANDREA Model U.F.O/5 Extra heavy duty Horizontal Miller. 86½in. by 19in. Table travel 67in.
VICTORIA U3 Universal Mill.
VICTORIA Junior Omnimil (New).
Two **ARCHDALE** 18in. Automatic Cycle Kneeless Production Millers.
VICTORIA Model V2 Vertical Mill (Nearly new).
CUNLIFFE & CROOM No. 2 Vertical Mill (dial).
ARCHDALE 34in. Plain Horizontal Miller (nearly new).

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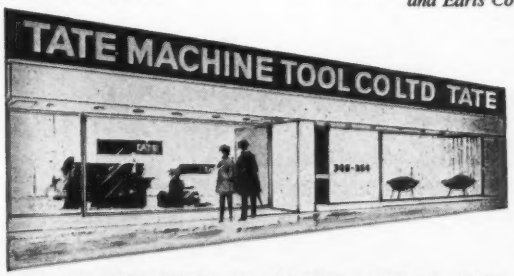

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BROWN & SHARPE No. 11 Grinder.
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HOGARTH S.S. Lathe.
D.S. & G. 13Z Lathe.
HERBERT ND Lathe.
SOUTHBEND 10in. Lathe.
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MILWAUKEE Simplex 12/24 Mill.
CINCINNATI Model 08 Vertical Mill.
MILWAUKEE 4H Uni. Mill.
MILWAUKEE 2HL Hor. Mill.
CLEVELAND Vertical Mill.
ARCHDALE 18in. Vertical Mill.
REED PRENTICE 3VG Vert. Mill.
KELLER 1210 Diesinking Machine.
KITCHEN & WADE No. 2 Honing Machine.
SENTINEL 25T Power Press.
ORMEROD 4in. Slotter.

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GLEASON 3in. Str. Bevel Gear Generator.
GLEASON 12in. Str. Bevel Gear Generator.
FELLOWS 7125 High Speed Gear Shaper.
FELLOWS No. 7 High Speed Gear Shaper.
FELLOWS 61A High Speed Gear Shaper.
HEALD 72A3 Internal Grinder.
GLEASON No. 16 Spiral Bevel Hypoid Gear Generator.

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***BINNS & BERRY** 9in. Centre Lathe, 9ft. b.c., 2in. h.m., swings 32in. in gap, Norton quick-change box, steadies chuck, etc. £225.
***DEAN, SMITH & GRACE** 6½in. × 36in. Centre Lathe, 3 and 4 jaw chucks. £275.
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DENBIGH No. 4 Fly Press on stand. £18.
SMART & BROWN Toggle Press. £20.
***SMART & BROWN** 4in. Precision Centre Lathe with chuck and collets. £75.
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***AIR PUMPS** Compressor, approximately 12 c.f.m. £85.

ALL MACHINES MARKED * ARE MOTORISED 400/3/50

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Cincinnati No. 3 Dial Type Horizontal Milling Machine complete with Universal Dividing Heads and Circular Table. Excellent condition.

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Herbert No. 4BS Capstan Lathe, fully rebuilt and guaranteed. Chuck model.

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RICHARDS No. 6 Horizontal Boring Machine, with 50in. dia. facing head only, will face 72in. Max. dist. facing head to outer steady 12ft. 6in., size of revolving table arranged for power and hand operation 6ft. 0in. × 6ft. 0in., size of main table 11ft. 0in. × 5ft. 0in.
KEARNS No. 5 Horizontal Boring, Facing, Drilling and Milling Machine, with 5in. dia. traversing spindle and 32in. dia. facing head, spindle speeds 41/208 r.p.m., size of main table 7ft. × 4ft., size of swivelling table 5ft. × 5ft.
PLAUERT Model H80 Horizontal Boring, Facing, Drilling and Milling Machine, spindle 3¼in., No. 5 M.T., working surface of swivelling table 35in. × 44in., speeds 5.6-1,000 r.p.m.
ROCCO AL76 Horizontal Boring, Drilling, Milling and Facing Machine, with 3in. dia. traversing spindle, bored No. 5 M.T., speeds 13.4-850 r.p.m., max. dist. centre of spindle to table 32in., max. dist. faceplate to outer steady 69¼in., size of swivelling table 39in. × 29in.
WEBSTER & BENNETT 36in. Vertical Turning and Boring Mill, max. swing 39in., max. admitted under cross slide 19in., speeds 2.8-62.5 r.p.m.

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WICKMAN 5in. Chucking Automatic.
RYDER Verticalauto, capacity 16in. swing × 8in., 6 spindles.

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KEARNS O.B. Horizontal Boring Machine. 2¾in. Spindle. Spindle Speeds 15/600 r.p.m. Excellent condition.
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JONES 6in. Spindle Horizontal Borer. Table 17ft. 6in. × 8ft. Spindle travel 48in. Rapid traverse 84in. per min. Motorised 400/3/50. Weight 70 tons.
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KITCHEN & WADE Vertical Fine Boring Machine, 14in. stroke. Compound table.

DRILLING MACHINE

ARCHDALE 8-Spindle Hydraulic Vertical Drilling Machine.

GRINDING MACHINES

BROWN & SHARPE No. 2 Surface Grinder 18in. × 6in. table.
KELLER No. R6 Tool and Cutter Grinder.
LUMSDEN D.E. Tool Grinder.
HEALD No. 172 Gap Bed Internal Grinding Machine, maximum diameter of component 36in.

LATHES

N.D. 8in. × 6ft. S.S. & S.C. Lathe. 30in. between centres.
SMALLPIECE Lathe, type 6 WSLMS.
NOBLE & LUND Heavy Duty Centre Lathe. 22in. centre height × 29ft. between centres Max. swing over saddle 33in. dia.
HARVEY Heavy Duty Centre Lathe. 42¼in. centre height × 52ft. between centres. Max. swing over saddle 65in. dia.

MILLING MACHINES

EDGWICK No. 2 Universal Milling Machine. Working surface of table 38in. × 7¼in.
BROWN & SHARPE No. 3A Universal Milling Machine with Vertical Head Attachment. Spindle Speeds 30/1,200. Power feed all movements.
COLLET & ENGLEHARDT Keller Type, Die Sinking Machine. Model FKf80, capacity 60in. × 30in

PLANING MACHINES

CLEVELAND Openside Planing Machine, capacity 10ft. × 2ft. 6in.
CINCINNATI Planing Machine, capacity 8ft. × 2ft. 6in.

MISCELLANEOUS MACHINES

Hydraulic Vertical Internal Honing Machine (manufactured by **PETER WOLTERS**), Capacity 0.2in. to 2in.
RAPIDAN Double Helical Gear Generating Machine, 12in. diameter capacity

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BRANDON ROAD WORKS, BRANDON ROAD, COVENTRY

'Phone:
WALSGRAVE-ON-SOWE 2253 (6 lines).

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ALL MACHINES MOTORISED FOR 3 PHASE SUPPLY UNLESS OTHERWISE STATED

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GREENLEIGH 11in × 6 spindle.
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KENNEDY 3A Power, 2in. type.
BORERS (Horizontal)
KEARNS No. 2.
BROACHING
AMERICAN Model H2, stroke 30in.
CAPSTANS
PITTLER TYPE RGII 82.
MURAD ⅜in.
HERBERT 4B and 4.
DRILLS
NATCO 24 spindle No. 1 M.T.
CORONA Type 15CX 2 spindle.
HERBERT 2 spindle.
MONMOUTH 4 spindle, No. 2 M.T.
ARCHDALE 3ft. Radial No. 3 M.T.
DENBIGH 24in. B.G.
HERBERT " C " Power Feed.
CORONA No. 21 AR, No. 3 M.T.
JONES & SHIPMAN 816, ⅞in. cap.
CORONA IAX, No. 1 Morse Taper.
LELAND GIFFORD 2-sp., No. 2 M.T.
HERBERT Type B. Single Spindle, ¼in.
CORONA 6MX Cluster Type.
HERBERT Type H, ⅛in. cap.
CORONA 12AX, ⅞in. cap.
ENGRAVERS
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HUPFIELD Router.
T.T. & H. Type C, and M.A.
T.T. & H. Multi Etcher.
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JONES No. 13 Bandsaw.
WICKSTEAD No. 1 Hacksaw.
RAPIDOR 6in. Hacksaw.
RAPIDOR Filing.
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Sheet Edging, 30in. × 22g.
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SAFAG Pinion.
MAXICUT 7in. × 2in. × 6 D.P.
PETERMAN No. 1 and 2.
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CHURCHILL HBY.
BRYANT 16/38 and 5.
GRINDERS (Surface)
CHURCHILL OSB 8in. × 30in.
LUMSDEN Vert. 210 XXM.
SNOW Table, 20in.
ABRASIVE No. 34 Vertical Spindle.
GRINDERS (Cylindrical)
CHURCHILL 6 × 36in. B.Y.
CHURCHILL PBH 12 × 36in. Uni.
NEWALL 6 × 18. Model XL.
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KEYSEATERS
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EDGWICK 4in.
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DEAN, SMITH & GRACE 7in. S.S. & S.C.
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DENHAM 4½in. × 24in. S.S. & S.C.
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SOUTHBEND 10in. Toolroom.
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CINCINNATI 08 Production.
CINCINNATI 1/18 Production.
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ST. ANDREA Model UFO3. Table 57 × 14.
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HARDINGE Precision. Table 25 × 6½.
WERNER. Table 14 × 5.
JONES 225 Univ. Table 22 × 6.
ARCHDALE 20in. dial and 14in. mfg.
RICHMOND O3. Table 40 × 10.
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REED PRENTICE No. 2.
BROWN & SHARPE No. 2 Light.
C.V.A. 79 Tool and Die.
REED PRENTICE No. 5, 68in. × 16in. table.
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BLISS No. 18. Adj. Str.
BLISS No. 16 Bar.
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WRIGHT Clicking Press.
PROFILING MACHINE
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NEWEY 14in.
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SLOTTERS
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Centreless Grinding Machine, maximum capacity 1¼in. diameter with Plunge Feed. Hand Operated. Motorised 400-440/3/50.

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SNOW T20 Table Surface Grinding Machine.
ARCHDALE 28in. Horizontal Manufacturing Milling Machine, with power and rapid feeds. Table size 49in. × 30in. 400/3/50.
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SOAG

ASQUITH HORIZONTAL BORER
Floor Type NHB3 IN STOCK !

MAIN DATA:—

Spindle dia.	5¼in.
Morse Taper	No. 6
Horiz. travel Column	12ft.
Vert. travel Workhead	8ft.
13 sp. speeds	5.2-250 r.p.m.
Spindle Motor	12½ h.p.

This travelling Column Borer, built in 1937, has multi motor drive and is in sound condition throughout. Inspection invited.
Full details from:- **SOAG MACHINE TOOLS, LTD.,**
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Classified Advertisements (*PLANT FOR SALE, contd.*)

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NEW LEN.63/280 Open Fronted Geared Inclinable Power Presses, with adjustable stroke from ⅜in. to 4⅛in. Pressure exerted 63 tons. Depth of throat 11in. Size of table 20¼in. × 29⅜in. Arranged motor drive 400-440/3/50.

Double Sided Friction Screw Press with cast steel frame. Pressure about 250 tons. Max. stroke 14in. Dia. of screw 8¼in. Width between uprights 22¼in. Tee-slotted bed 19¼in. × 20¼in. Tie bar construction. Arranged motor drive 400/3/50.

BLISS No. 18 Inclinable Press, with single roll feed. Pressure about 8 tons. Stroke 2in. Centre to back 3¼in. Bed 14in. × 8¼in. Length of feed variable 0-2¼in. Size of knurled feed rollers 2in. dia. × 2in. wide. Arranged motor drive 400/3/50.

BLISS No. 85 Double Geared Double Sided Reducing Press, with straight sides. Pressure about 50 tons. Stroke 14¼in. Between uprights 22in. Bed 21in. × 21in. Hole in bed 9¼in. dia. Spare crankshaft with 5in. stroke. Friction clutch. Arranged motor drive 400/3/50.

TAYLOR & CHALLEN No. 3½DGDP. Double Sided Double Geared Double Action Cam Drawing Press. Punch stroke 10in. Blankholder stroke 5½in. Between uprights 22in. Bed 20in. × 19½in. Blankholder 12in. dia. Punch 5in. dia. Bed fitted with ejector. Operator's guard. Arranged motor drive 400-440/3/50.

TWO **BRITISH CLEARING** No. DH-55-35-30 Double Sided Double Action Hydraulic Presses with steel plate frame. Pressure exerted, punch 55 tons, blankholder 35 tons. Max. pressure by both slides, 90 tons. Punch stroke adjustable up to 8in. Blankholder stroke adjustable up to 4in. Width between uprights 32in. Bed 32in. × 30in. Blankholder 26in. × 30in. Hole in blankholder 21in. × 21in. Cushioned bed. With all hydraulic equipment including pump. Motorised 400-440/3/50.

Photographs of the above are available.

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MACHINE TOOLS, NEW AND USED, Of Every Description. Attractive Prices

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Telephone: EUSTON 5000. Telex 24264.
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Corona Heavy Duty Vertical Drilling machine. No. 5 Morse Taper Excellent condition.

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URQUHART LINDSAY

16ft. 0in. x 5ft. 0in. x 5ft. 0in.

PLANING MACHINE

Lancashire Dynamo Drive 1942 machine in excellent condition.

NORthern 9071

Mitchell 8¼in. S.S. & S.C. Gap Bed A.G.H. Lathe with 3in. Hollow Spindle. Speed range 30-400 r.p.m. Further details from:

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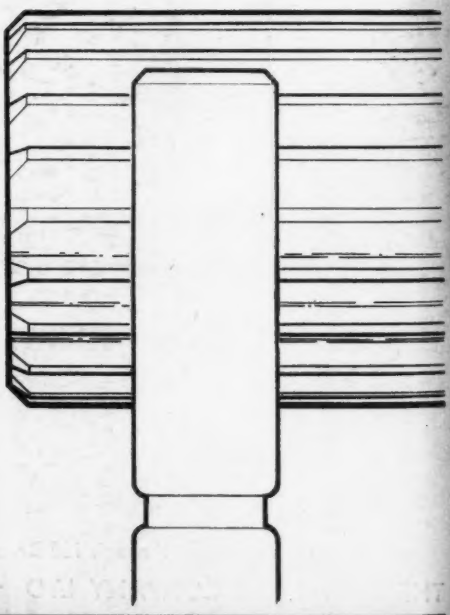

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